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Wisdom of the Ancient Forests: Stories in the Living Thread

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Master's Field Project

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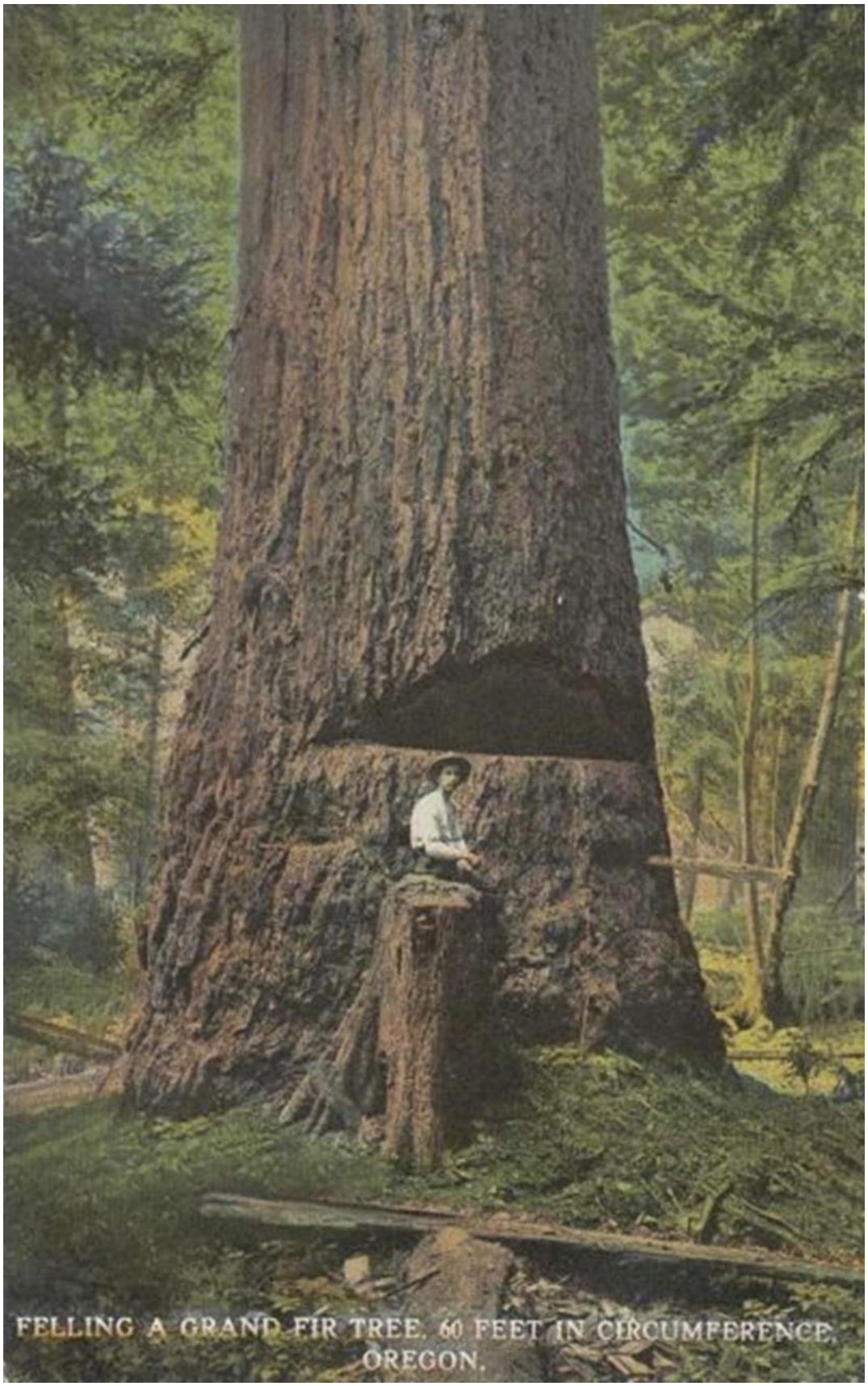

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What is the essential quality of human beingingness? I would argue it is always looking to balance our desires and our knowledge of the need for restraint and to seek a balance in our sharing and selfish selves, our simple and greedy selves. And, telling stories about this seeking to try to understand them and blend them with the stories of others for greater understanding and reinforcement of sustainable ways of being in the world.

Ted Aoki

Preface: Lay of the Land

In this project I have taken the reader on a personal journey highlighting foundational and transformative experiences in my, Nick Sky, evolution as a teacher and a learner. This project also explores the origins and evolution of my values, biases, and worldview that inform the way I teach and learn. The primary goal of this project is to create a theoretical base for a form of education that I am advocating for, which I call "natural complexity education". This form of education will blend, or maybe re-blend is more accurate, elements of complexity education and holistic natural history education. Holistic natural history education, by my definition, is a whole systems approach to learning about the living systems of planet Earth, past, present, and projecting into the future. I use the term "holistic" because my approach includes all the elements of natural history within the traditional scope in the "Western" tradition, but also with an expanded transdisciplinary approach that includes elements of sociology, anthropology, economics, politics, and psychology to create a more whole picture of the natural history of ancient forests of the Cascadia region, for instance. The term "complexity" can be fairly amorphous. I am defining complexity through the lens eco-cultural resiliency. That is, complexity is defined, and assessed, by relative levels of biological diversity, cultural diversity, and the diversity and intricacy of ecological structures. In my definition, those systems that are complex are those that sustain and enhance high levels of these previous elements and therefor lead to

resilient eco-cultural systems. Put another way, in complex systems life begets life and more life begets even more life and so on... Complexity, by my definition, is a relative/comparative term. There are no places or systems on Earth, as far as we know, without some level of complexity and to our knowledge there is no peak to the level of complexity systems can have.

The methodological layout of this project will be a series of experiential stories which illustrate ways in which world views that embrace the principles of complexity holistic natural history can form and evolve. Most of these stories take place in, or relate to, the ancient forests of Cascadia. Each story focuses on a varying number of key aspects of my teaching philosophy and methodology. I will also often link forward and back between stories to help illuminate a larger body of theory in a manner that is in keeping with the principles of complexity education, meaning this approach is non-linear, reflective, transdisciplinary, and holistic.

In the style of Cynthia Chambers, I have woven into my mosaic of stories: analysis, explanations, interpretations, and justifications of my methods and project goals. I also acknowledge and examine my biases. I have, as Chambers suggests, “Pursued a curios and thoughtful examination of [my] topic,” and, “Carefully examined…[my] own doings and actions and [my] character and spirit, as well as how those are historically shaped and socially situated” (Chambers 2004, p. 2).

Most of the stories in this project are about my first hand experiences, they are autobiographical/autoethnographical. I will also use number of stories and accounts from people other than myself and use these narratives to make a points of connection in the broader human experience.

Stories, and sections not in story format, will focus, to varying degrees, on key aspects of my teaching philosophy like: Emotion, complexity, time, space, biodiversity, community teaching, field education, holistic natural history, interactions between different value sets, what it is to be human, resilience, sustainability, mutualism, and ancient forest natural history, including the interplay between humans and ancient forests.

Each section of this project will at least touch on a good number of the topics listed in the preceding paragraph since all of these topics are in fact merely different facets of the same whole and they cannot truly be separated. In my opinion, to do so might validate and reinforce dangerously inaccurate worldviews that abound in my culture.

From the list of topics covered it should be clear that there will be a fair amount of natural history content. In the balance this will not be the primary focus of this project, however. Holistic natural history, as I have implied, is essential to my natural complexity curriculum theory, and it is the area in which I have a good deal of experience and expertise, but I have chosen to give more space to elements of philosophy, including cultural values and beliefs, sociology, emotion, and environmental/ecological literacy. Of course, all of these elements are overlapping and have been interwoven with natural history elements.

In this project I will make the case, through a variety of methods, for why I believe natural complexity education should primarily take place in the ancient forest of Cascadia.

The levels of focus of the stories will vary quite widely. Some of these stories are about singular events others are about a series of events in an evolution of understanding and some are about something or someplace I have experienced many times. To this last point, there will be repetitions and re-interpretations of certain stories, literature, and concepts, but this is all part of reflexive methodology of natural complexity education.

In keeping with the inquiry base of natural complexity education, I am not “spelling every detail out”. There will be explanations and definitions, often in the footnotes, but in the end the teacher/student reading this must be able to make an interpretation that is their own, in which they find connections to their life and to their teaching and learning. That is to say, the framework is there, but each interpretation is unique.

I will admit that the creation of this project has been a challenging experience due in part to the nature of complexity, that is that it is by nature a complex subject, and also due to the fact that I am writing this paper

within a culturally constructed educational and societal structure that is not very inclusive of educational approaches that embrace complexity and holism.

This project is not an end product, in natural complexity education there is no endpoint. It is my hope that this project will be the kernel from which a much larger undertaking can grow. This will allow me to expand and also focus in to try to give more weight to the vital importance of seeking understanding of the intricacy of the world.

Introduction: Roots

This project is the story of a life-long passion for learning and teaching and a life-long love of the beautiful, majestic, complex, and diverse ancient forests of my home region of Cascadia.[1] This project also arises from very deep concern about the shockingly quick, disturbingly severe, and completely global trend in the loss of multifaceted natural systems, such as ancient forests, overwhelmingly due to human actions. This is a story, composed of smaller nested stories, of searching for answers to mysteries and of searching for connections, especially emotionally charged connections, between cultures-individuals-species-natural systems. I am telling this story to try to articulate, as best I can, the insights I have found in complex nature and in the stories I have been privileged to hear from others about their interactions with the broadly ranging

[1] For purposes of this paper I am defining the Cascadia region as the portions of the states of Oregon and Washington West of the High Cascade crest, western British Columbia (including Vancouver Island and Haida Gwaii), the panhandle and south-central Alaska and the Northwest corner of California. This is in general an area bound by floral and faunal similarities and similar ecological systems, like temperate, conifer dominated, ancient rainforests in a continuum from strongly seasonal to year-round rainfall types. Many of the key attributes of this area could also be applied to some inland marine influenced areas of B.C., Idaho, and Montana

expressions of life. My hope is that telling my story of seeking understanding, empathy, and belonging will encourage others to find and tell their stories of transformative experiences in their lives. My hope is this will help in some small way add to the living, growing, adaptive body of eco-cultural knowledge and this will lead to a cultural shift towards behaviors, towards ways of living, that can be sustained.

In this project I advocate for a natural complexity approach to environmental education. I take a strong position because I believe a deep, broad, and emotionally connected intelligence with regards to the value of natural complexity is necessary to maintain high levels of ecological resilience in the face of constant environmental change and in particular the very recent trend of vast human excesses in resource manipulation and consumption that has shifted the regimes/cycles of diversity enhancing ecological disturbances into a new "place" where ecological degradation is undermining the ecological base on which humanity depends to thrive and in the end to merely survive.

This project seeks to provide environmental educators, which in my opinion should be every educator, with a theoretical framework to seek more accurate world views that foster complex, resilient cultures/environments.

I argue that the natural complexity education approach I am advocating for is essential because environmental education seeks to motivate changes in environmental behaviors, that is, it is prescriptive and inspirational, as well as academic. I would argue that the ultimate goal of environmental education is to foster the more sustainable elements of humanity and temper the less sustainable sides of human behavior to a degree that foster high levels of natural complexity, which enhance eco-cultural resilience, which allow for the possibility of human sustainability.

As I stated in my preface, this project is not an end product by any means. This project does not spring from a linear progression of understanding with delineated steps, it is a moment in space within the complex web of intersecting and diverging paths, with no end sight. The previous passage may seem overly esoteric, but the nature of complexity is not an easy thing to express. In my decades of experience, I have only been able

to grasp onto tiny snippets of understanding, but this keeps me searching for more and it keeps me humble knowing that as one human with limited time to enjoy Earth I will only grasp a minute fraction of the complexity of life and I am happy in the fact that there will always be mysteries, things unknowable. Seeking to understand complexity is a life-long process, it is a communal process, it really must be a multigenerational process. This quest to understand life is to my mind essentially human and essential to humanity.

At this point in my personal story I can look back on my life and realize that the roots of my worldview, of my values, extend to some of my earliest perceptions of the world. When I was young I would not have used the word complexity, but from my current vantage point it is clear that it has always been an understanding of complexity in nature and culture I was seeking. As long as I can remember I have wanted to teach and so I have never wanted to keep what I have learned about the natural world to myself. I have always been eager to hear others share what they how they have interpreted the experiences of their lives.

A Sense of Place

Although I was born in San Francisco, I grew up in Western Oregon in the heart of the Willamette Valley[2] in the 70's, 80's and 90's, close to some of last vestiges of some of the greatest forests the planet has ever known.[3] Very early in my life I became aware that my friends and classmates were not as interested in the mysteries of the natural world as I was; this division would sadly only grow with time. There was a troubling distance between us with regards to how we understood and interacted with the rest of the world. I was

[2] In a Latinate sense this was literally true since my hometown was Corvallis, which translates to English as, "heart of the valley".

[3] I say "greatest" and this shows my bias for tall trees, huge trees and trees attaining ancient ages. This bias is in part I think part of being human and is also from my understanding of ecology, of biomass, water retention and structural complexity.

always, at least as far as I can remember, interested in plants, trees in particular. This orientation set me even further apart from most of my society where there was a hierarchical ordering of the how various organisms were valued: humans at the top, then animals, then maybe plants. This is a simplification, but I think the point is clear, the more closely related to humans the higher the value, the deeper the feelings of connection.

In elementary school my favorite subjects were history, I liked unraveling the stories of time, geography, I liked to contemplate spatial aspects of the world, and the natural sciences, natural cycles and the diversity of the expressions of life fascinated me. These were the subjects that gave me *joy, that made learning fun.* It is this sense of delight that keeps these ways of knowing, of seeking to understand, foundational to me to this day, and hopefully well beyond.

When I found out that most adults, who I assumed knew everything, had very little knowledge of what I already knew was a very fragile natural world, I felt a range of *emotions.* I was surprised, shocked, sad, mad, frustrated, and confused. How could they not see it?!

Being raised in a very politically and environmentally aware family, I knew from an early age of the massive damage being inflicted on the ancient forests of my home-region through the process of industrial scale logging. Even as a young person I questioned where the path dictated by the dominate values of my culture would lead; I was not optimistic. My awareness of the political aspects of life allowed me to see the growing clash of values that was taking place over the last ancient forests remaining in Cascadia. The furor really started to kick up in the late 70's and especially the 80's and this period was framed as the "Timber Wars". I still remember the protests, the debates, the television stories and ads, and the magazine and newspaper articles. In my youth there was no doubt which side I came down on, no ambiguity about who was right and who was wrong.

When I grew up in Western Oregon it was truly "timber country", whether I liked it or not. The region I lived in produced more timber than any other in the United States and the value of that timber exceeded that cut

in any like sized region in the world (Eckenwalder 2009; Prudham 2005). I remember the loaded log trucks and the sounds and smells of the humming lumber mills and the eerie, but fascinating, beehive burners, now cold and rusting[4]. It was hard to be someone who cared about the ancient forests living in a region with such a strong logging and milling culture. In my life in Cascadia I have stood in numerous sublime groves, endless shifting patterns of dappled light displaying the intricacy of the canopy in a manner so beautiful that the fact of complexity entered seamlessly into my mind. I saw time displayed in myriad layers and I wondered about the future of each ancient stand as I took in everything in peaceful contemplation and a silencing sense of awe. There were deep divides in how groups in my homeland perceived the greatest value in ancient forests and there were many who eagerly exploited and enflamed those divides. The loggers were there because the trees were still there. Because the trees were still there I could experience them, but if the logging continued it was obvious that the chance to experience ancient forests would largely be lost to me and to everyone else. I experienced these contradictions and these divisions and they tore at me. Love, hate, fear, and hope all swirled in my mind.

Ancient Douglas-fir dominated the timber industry in the region I call home. My relationship with this tree was complex. Douglas-fir was the first tree I could identify by sight, smell, and touch. Olive drab needled stands of this tree have been both the background and the focus for much of my life. The smell of pitch, cut wood, or sunbaked needles still connects me with emotion tinged nostalgia to many experiences throughout the span of my life. [5] This tree was, and is, for me a touchstone in the meaning and feeling of home. I am sure a great many humans have a tree that reminds them in a deep way of home. For me it was natural that it was the Douglas-fir. Regarding connections to my family, Douglas-fir was also overwhelmingly the tree species my dad was planting on the vast clear-cut lands of our corner of the Cascadia. In fact, the vast area of the west of the crest of the Cascade Mountains was commonly known as the “Douglas-fir Region” (Prudham

[4] A large metal structure shaped like a traditional Dutch beehive that was used to burn the immense amounts of wood “waste” left over from the milling process. Their use was banned as clean air regulations became stronger.
[5] I find the connection between smell and memory and emotion fascinating and the smells of the forests have become more and more important to me in large part due to this connection of identification and emotion.

2005). The ancient stands of this tree permeated and shaped the culture I grew up in. Due to the narrow set of privileged values through which my culture evaluated Douglas-fir, I had mixed feelings about growing up in the Douglas-fir region. There was no question this tree was ecologically dominate over vast stretches of the region, but it was obvious that this designation held in it contested meanings because the economic valuations seemed to reign supreme even though this tree was a hub of natural complexity when allowed to reach its potential.

Given what I was learning, it was apparent to me that my families' views on natural systems, such as ancient forests, were at odds with strong dominate cultural values that determined desirable and undesirable aesthetics in landscapes. Was my culture the problem?

Despite strong cultural marginalization of Native American peoples of Cascadia, gradually I started to become aware of the fact that Native Americans had lived in co-evolutionary relationships with ancient forests that spanned whole generations of ancient trees. I started to wonder what made Native American interactions with ancient forests so different from the interactions of my culture with these forests. I will admit to some "Noble Savage" idealization of Native Americans, and of growing dislike of my culture's values, but even accounting for these biases I cannot escape how differently the outcomes were when "Western" values and Native American[6] values were applied to ancient forest landscapes. Obviously there were very different philosophies regarding ancient forests at play.

With time my world view broadened beyond my home region, I realized that the manic paced story of ancient forest exploitation and depletion had played out in many other ancient forests around the world. Stories from other regions of the world that contained temperate ancient rainforests showed me that very similar histories unfolded anywhere ancient forests and capitalist colonizers met: Tasmania and the southeast Australian mainland, Chile, New Zealand and so on… The results of the interactions between capitalist culture and temperate ancient forests were very similar even when the forests involved grew in

[6] I am referring to some relatively universal practices across a great diversity of peoples/nations.

lands very distant from each other and were composed of quite different species. An understanding was dawning on me; the ways in which humans valued ancient forests were the most powerful factors in how far and fast the process of ecological degradation would proceed, or if it would proceed at all. I could see that these far flung forests and my home forests were all connected by ecological and ethnobotanical[7] histories.

The hunger for raw materials to feed a globally spreading culture of material excess was coming down on these fantastic forests. From my experience, many were of the opinion that this was very good thing, but my family and I, and a growing number of other people, did not agree with this simple assessment. These forests seemed to have value in and of themselves and values to humanity beyond mere building materials.

Visual Corridors, Meander Scars, and My Own Backyard: Radical Transformations of Natural History Worldviews

During most of my youth my father "worked in the woods", still a common phrase when I was young. He took the family to spend much of our free *time* in these woods and so I was introduced to the ancient forests of Oregon at an early age; before I could walk. My father was a tree planter for many years. In this job he came in after the clear-cuts and he experienced the environmental damage of industrial logging in a very real and personal way. He would tell me that there was a sliding scale for the severity of environmental damage done depending on who was doing the logging. The most severe damage usually came at the hands of the biggest international timber corporations and the least damage was, on average, to be seen on the lands logged by local family owned logging operations. I would only really start to pay attention to these distinctions years later, in my youth I *hated* all loggers and timber companies. Now, in general, I feel that most loggers were victims, like the ancient forests, of a corporate timber industry that seemed not to have little concern for

[7] I am using a broad definition of "ethnobotanical" which encompasses all interactions between humans and plants.

local forest environments and the resilience of local economies and communities. In time I started to see corporate dominance and the whole capitalist mindset as the true threats to the forests I loved.

From many years of experience my father was able to navigate the *vast maze* of logging roads that were imposed on the valleys and ridges of the Coast Range and the West Cascades of Oregon. I would point out that my use of the words "vast" and "maze is in no way hyperbolic, in fact they understate the reality I experienced. My dad took me to scenes of incredible beauty and places with razed forests that were hard to look at, that offended my sense of what was right. I did not need to be told this wrong, this feeling hit me the moment I saw these obliterated landscapes. This was not like seeing a forest that had burned in fire. I had seen many burned-over lands and the obvious difference between these places and a clearcut landscape was that most burned landscapes important ecological legacies of the pre-disturbance ancient forest[8]remained and ensured a quicker recovery of the qualities of ancient forests.[9]

Through these educational excursions beyond the "visual corridors", thin lines of trees hugging the main roads, I came to know in a visceral way how quickly and completely the former beauty could become the latter desolation. These sensory and perceptual screens, these green growing facades, served to hide the truth so as not to offend and to not allow minds to even start to wonder how vast the destruction truly was and what the consequences of this destruction might be. I remember our car slowing to shift from pavement to gravel. Minutes later, sitting on the other side of the fence of trees, I would get a shocking dose of reality. After we had painfully taken in the scene, we would drive on. As great as the destruction had been on "the other side of the fence", it paled compared to the revulsive panoramic landscapes I would see when we crested the ridges that flanked the highway. The rugged topography of my home region and manipulative sensory screens rendered the scale of industrial logging essential invisible to all but a relative few. It was also

[8] Organic soil layers, downed wood, snags, and snags created by the fire, and usually a number of living trees in various states of ecological health depending on the variance in fire behavior.

[9] In, *Do remnant old-growth trees accelerate rates of succession in mature Douglas-fir forests?,* William Keeton and Jerry Franklin look at the positive ecological impacts of biological legacy old-growth Douglas-firs (Keeton and Franklin 2005).

unnerving that in a more-subtle way the dense, green, vibrant looking plantations that covered these landscapes after replanting came to be seen as signs of forest/environmental health thereby not just hiding, but really erasing much of the perceived damage of industrial logging. This was the case at least among those without much natural history knowledge of the situation and as I have already pointed out that would cover a large majority in my culture. Under this way of seeing the forest, or not seeing the forest as the case may be, all forests just became *a* forest and a forest was just trees. For many people even when they recognized ancient forests they were perceived as monotonous in their sameness and often even worse: messy, chaotic, ugly, dying, wasteful, scary, untidy and so on… After many miles of driving, dust trail swirling behind our car, I would see the grove we were looking for. The isolated oasis of multi-textured, multi-hued, green stood out so starkly from the ravaged land surrounding it. These stands almost did not look real in their isolation, they had the appearance of lost magical realms only seen through a portal of perception, a hole in the fabric of time.

The combination of these excursions into forest, and reading accounts, and viewing photographs of the logging history of Cascadia, I realized that by the time of my youth ancient forests were quite rare. In reality all uncut ancient forests had become ecological islands of one size or another. It had come to a point where it seemed more truthful to say ancient "forests" instead of ancient "forest" because the landscape covering continuum of overlaid ecological mosaics was now clearly and severely divided. The realization of this complete flip in landscape space was made all the more impactful when I found out how recent this situation was and this new view of the temporal aspects of the story sent me reeling. I was amazed that not long ago ancient forest had covered most of the lands west of the Cascade crest, and large areas east of it too. (Loy, Allan, Buckley and Meacham 2001) This was a dramatic shift in my understanding of my home region.

In an interesting cultural comparison, ancient forests have been integral in the lives of hundreds of generations of Native Americans for thousands of years and yet at first they were great obstacles to early European Settlers trying to create agrarian "Neo-Europes" in this lush "wilderness" corner of the world

(Crosby 1986). By the time of my childhood, as my narrative illustrates, one had to search for ancient forests, inquiry about them, and then drive long distances on rough, confusing roads dodging fully loaded log-trucks that barreled down hills and around blind corners. I learned that if I could have stood where my childhood home now was a mere human lifetime ago that when I looked west to the Coast Range and east to the Cascades my vision would have fallen mostly on ancient forest covered slopes and flats. There was an unfathomable loss of landscape space occupied by very complex living systems. Numbers and statistics could be created, but I believe the true loss was beyond the capacity of the human mind to grasp. In time I also learned that the ancient trees remaining in my lifetime gave an incomplete and inaccurate idea of the biological and ecological potential of the giant trees of these forests. The perception one was left with meant a serious underestimation of potentials for size, height, structural complexity, and age. To give this last point some perspective, years later I would read Robert Van Pelt's *Forest Giants of the Pacific Coast* and *Al Carder's Forest giants of the world: Past and Present* and I would see pictures of the some of the largest trees remaining and even larger trees of the past. In time I would visit a good number of the remaining trees and each time I did I was amazed by just how much larger these trees were than most ancient trees I experienced and using these incredible trees as a reference point I could almost envision the even larger giants of the past, not just as black and white photographs, but as living trees. Looking at the photograph of an immense Douglas-fir in the early stages of felling, on page 2, I can say that with all the giant trees I have visited I have never stood by a tree that was close to that size, especially among the so heavily logged Douglas-firs. Another natural history hint in this picture, and most pictures that were taken of the very largest trees in Cascadia, is that the topography where the tree is growing looks quite flat. This would indicate a tree growing on a river bench, or raised coastal terraces or fringing a lake or wetland removed just enough to not be too wet for Douglas-fir. This also indicates low elevation and therefore on average better soil quality and of course longer growing season. In fact, the only topography really visible in this picture is the large "pedestal" that this incredible tree grows upon. This now green with vegetation mini-hill is the accumulated mass of maybe 1000 years of falling needles, twigs, branches, male cones, female cones, pitch, pollen,

lichens, mosses, dead insects, bark flakes and so on… much of this organic material of course has decayed into the nutrient system, but this tree is so vigorous and so old that the mound is still very substantial. Due to the fact these flat low elevation sites were where people wanted to settle first and settle in the largest numbers and the trees were easy to access and even comparatively easy to extract when cut, these are the sites that were logged off almost completely. This fact is backed up by the fact that in this picture, and in the vast majority of pictures of ancient tree pictures, the tree is in the process of being felled. The style of dress of the pictured logger and the type of photography used, it appears to be color tinted tintype, and the size of the tree seem to indicate that this picture was taken in the last quarter of the 19th century (the 1800's). For me these picture look somewhat odd, a piece of history, because so very often most ancient forest hiking takes place climbing, descending, and traversing slopes, usually far from my house. While reading these books it occurred to me that the old logging photos were so hard to look at was because I knew that *if* trees like those in the black and white photos were to exist here again it would not be for many human lifetimes; I would certainly never see them.

Also, with the increase in research and general circulation of the research on old growth of those Like Jerry Franklin, Chris Maser, Jack Thomas and others, I realized that what was being lost was not just towering, grand, and ancient, but also endlessly[10] complex. This made the logging that I was observing and fighting all the harder to understand. In the early days people could claim ignorance as to the workings of ancient forests. They still knew that logging had in many cases crossed a line in terms of moderation and ethics, but forests were still seen in terms of the resource values they could deliver humans. What some were calling for was wise conservation of these resources through moderated rates of utilization; this is conservation not preservation. In this view the forests still had little intrinsic value. With the surge in research in the 70's and even more so in the 80's it was becoming clear that ancient forests were not "biological deserts", "cellulose cemeteries", or the "graveyards of the forest", as many had called them. This knowledge had been out there

[10] I say "endlessly" because these forests are so ecologically complex that in terms of human comprehension they are essentially endless in their layers of complexity.

but it had remained very much at the cultural margins. Just saying that these labels for ancient forests had been wrong very much understates reality. Ancient forests of Cascadia are some of the most biologically diverse, ecologically resilient, biologically productive living systems in the entire world. This is another case of things being a matter of degrees it is isn't just that our cultural perceptions got it wrong they were *almost as wrong as they could be*. What does this observation say about the chances of Western culture persisting for very long?

The ecological transformation of much of Cascadia had been so complete I could only try to imagine what these lost forests had been like. Oh, how I wished I could see them, walk through them, explore. When I was young there were people alive who had. Through my father I met "old-timers" who had experienced ancient forests that were so extensive and contained such huge trees that when they were young they could not imagine it all being practically gone.[11] It was almost the perceptual opposite of my childhood experiences where I could only *imagine, never directly experience,* extensive ancient forest covering much of the landscape. The rate at which very high levels of natural complexity had been reduced to very low levels over vast spaces was mindboggling and very worrisome even to someone just starting to understand the complexities of the world.

Despite this very grim assessment, I was also very happy and felt very lucky that there were still ancient forests to experience. I felt from an early age that in the ancient forests lay hope for a better future. There was something powerful about the fact that, despite the power of dominate cultural forces, all the ancient forest was not gone. The pieces remaining could be reminders of what had been and could be. They could give ideas as to how at least some of this complexity could be restored, and why it should be. These places

[11] Even during the youth of these elders, logging had already been occurring in the area for decades, but only the trees very nearby human settlements, especially larger settlements, the trees easier to fell, transport and process had been cut to any significant extent. On the whole the landscape contained so much ancient forest upon the slopes and up the valleys that it would be hard to imagine almost all of it being gone within the lifetime of a young person

are ancient "texts" on which lessons to human survival were written in myriad forms and languages. It has been my life's work to learn to interpret these languages and help others do the same.

It was part of growing up to see log trucks loaded with big logs skinned of their branches, bark battered by the violent process of "harvest". I knew from counting rings on stumps and felled logs that these trees were very old. I was starting to contemplate stretches of time that were far beyond what I could experience in my life. Since I liked history I also started to tie the ages of ancient trees to human historical events and this gave me a deeper perspective and appreciation of the scales of time in ancient forests. This expanded perspective and appreciation of time is a powerful motivating force for me to get learners into the forest. I knew the kind of exploitation I was witnessing could not continue at this rate, could not be sustained. I knew this even then. The time it took for these trees to grow and the rate at which they were being cut down just did not add up. I did not know it but I was starting to grapple with the age old questions about humans and sustainability.

At around the same time that my understanding of the forests in my homeland were changing drastically, I started to uncover evidence that the Willamette River, my home river, was not what it appeared to be and that my understanding of what a river is was flawed from an ecological standpoint. I grew up in the middle of the Willamette Valley a few miles outside of the town of Corvallis. On my family's frequent drives into town we would pass beside and above *the* channel of the Willamette River. I loved looking down at the brown flowing water fringed by cottonwoods and willows. To me this scene became the image, the model, of what a river was. The river here was very gently bending, often flowing almost straight, deep, uniform in width, single channeled, with cleanly defined banks rising at steep uniform angles to where the road was. There were thin lines of young to mature cottonwoods and willows lining the banks one, two, or three trees deep. In some places however, the trees were completely absent, with grass or rip-rap[12] coming right to the water's edge. As I have indicated, the channel was deep and relatively straight and there were almost no logs as

[12] This was the application of large amounts of large stones to river banks and sloping river banks to harden/armor these banks against erosion and lock the river channel in place. These structures were especially important since the trees and log jams were largely gone and water now flowed faster and with more force and flow increased more quickly in during periods of heavy rains/and or snowmelt.

obstacles in the water and so even though the valley was quite flat, and therefore the river low gradient, the water in it flowed at a relatively fast rate. I knew this from personal experience having floated down portions of the river multiple times. I had been to the mountains and marveled at the rushing whitewater rivers, but since this stretch of the Willamette was what I experienced far and away the most, this was what I thought of when I thought of a river. It was a powerful image and a scene that provoked strong emotion.

In time I learned that the river-scape that created this powerful image was a recent construction. It seems that the Willamette at this spot, and along its length in the valley, did not at all resemble the river that such a short period of time ago had flowed thorough this fertile lowland. The Willamette River had been much more complex, varied, expansive, and ecologically productive. The Willamette River of the very recent past had been a beautifully complex braided weaving of multiple channels that were constantly migrating, shifting, and meandering, sometimes over an area more than five miles in width. The river pulsed and changed with time and the seasons and rising and ebbing of water entering this vast green system. Besides all the active channels there were myriad flood, side, and dry channels. There were many sloughs, backwaters, oxbow lakes and extensive marshlands and instead of non-existent, to barely existing riparian corridors of trees, shrubs, and herbaceous vegetation, the broad network of channels was surrounded by, and infused within, by vast ancient riparian forests containing some of the largest and tallest angiosperm, “broad leaf”, trees in the world and dense and diverse smaller trees, shrubs, vines and herbaceous plants. These forests averaged over a mile wide on each side of the outer part of the then extensive flood plain and in places where major tributary rivers added their waters these forests could stretch seven miles wide. These places were water and land meet, mesh, dance, are some of the most productive living systems in the world (Phillips-Metzger 2013; Defenders of Wildlife 1998; Maser and Sedell 1994). Vast tree canopies overhung the channels and I wondered how Fall must have looked and smelled as sweet earthy smelling golden leaves in giant rafts and streamers covered the water and flowed down stream in shimmering ribbons. As the *mostly*

deciduous trees of these *low elevation* [13]riparian ancient forests aged and died some stood as snags and many others were toppled by wind or flood or migrating channels, their trunks, roots, and branches filled the river and the floodplain with huge log jams, log rafts, submerged logs, partially submerged logs and logs buried in the mud, sand, and rock. These complex structures shaped flows and made the whole system that much more productive, diverse and resilient (Maser and Sedell 1994).

To ease the navigation of boats used for transportation of people and goods and for flood control and the creation of new farmland, the Willamette River was radically transformed and its complexity and productivity greatly reduced. The drained wetlands, oxbows and sloughs became some of the richest farmlands and also where the sand and gravel mines sprung up. Sand and gravel for concrete to supply materials for construction, which was ramping up in Cascadia and beyond.

Things that had puzzled me about my home landscape started to make sense. The sign for Owl Lake road now distant from the river and not even close to the mountains, in a place you would not expect to find a lake, and the odd green canyon near my house where no creek flowed. These were in fact an old filled in oxbow lake and a drained slough. I was reading the land now not just for what was there, but for what was not there. I feel this was moving into a new depth of natural history where I used more-subtle hints in the landscape to interpret the ecological complexity potential of my home territory. I was seeing and starting to understand what Abby Phillips Metzger calls, “meander scars”, in her book of the same name (Phillips-Metzger 2013). We tend to think of scars as signs of injury and yet these scars were the last remaining signs of a much healthier environment, a time when waters took very intricate and varied paths that led them in a very unhurried way to the sea. Even though scars show injury they are also signs of healing and these meander scars showed the shaping of great forces, but when the tearing and tumbling and burying and

[13] At higher elevations there would still often be a deciduous component to the forest, especially lining the river channel, but the proportion of conifers, and conifer wood in the river and floodplain, would be far higher. At lower elevations the proportion of deciduous trees (cottonwoods, willows, ash, alder, dogwood, hawthorn and many others) was higher but there were conifers present at varying levels (cedar, grand fir even some ponderosa and sugar pine, which is no longer found in the valley, and Douglas-fir in the right microclimates).

uncovering were done life abounded and the complexity of the whole system was enriched. I knew I would never see this lost Willamette River or the Magic forests it had drained, but I knew some of this complexity could and should return. Even though we individual humans could not live to see these forests and rivers we could help move towards them and feel good about doing what is right, about embracing moderation and slowness. Great amounts of complexity had been lost, but in remaining complexity, and knowledge of the past, lay hope.

My home was not what I thought it was. As beautiful as it was it had so much more potential and I wanted at least some of those lost natural wonders back. I learned that in lands colonized by my culture it was never wise to assume that the natural systems that one encountered represented anything more than a recent anomaly. In learning botany and horticulture, I came to realize that this disconnect in my home region extended into the everyday spaces of school, the neighborhoods, and even to my own rural backyard. I learned that most of the plants that I saw every day, that were the back ground to life, were not native to this part of the world. Numerous plants species had been brought here from other parts of the world: the eastern U.S., Europe, Japan, China and many other places. In time I realized that in human constructed spaces overall biological diversity and ecological complexity[14] was far lower than in native ancient forests. I know some would say, "Humans are a part of nature and therefore anything we do is natural, including importing plant and animal species from around the world." They might go on to say, "Doesn't the transportation of plant and animal species to this area increase overall biodiversity?" I would not argue with the first part of the first statement, but if human resilience and sustainability are the goal, and how could they not be, then I must problematize this assertion. One threat to the eco-cultural resilience of Cascadia was that a number of non-native plants and animals, some brought intentionally some unintentionally, naturalized to the new space and some of these became invasive and became a force in lowering ecological diversity and complexity in the region. Another factor is that even the large majority of species that do not

[14] The ecological structure and "texture", spacing, of ecosystems

naturalize,[15] and therefore do not even have the *potential*[16] to become invasive threat, still do not help build the vast complex life webs that native plants do with other plants, animals, fungi and an incredible diversity of microbial life. What I realized was that the most common of spaces in my life, and the lives of other Americans, were *greatly* simplified ecological systems. This is not to say these systems are not still complex, but compared to the systems they have replaced in a relative blink of an eye they are far less ecologically complex. The issue for environmental educators, and much of humanity now, is that the systems at the lower end of complexity continuum now dominate huge swaths of the Earth's surface and Cascadia is no exception.[17] Crucially it is these simplified systems that people experience the vast majority of the time. Humans in the "developed" world spend a great amount of time in relatively small, enclosed constructed spaces where there is little habitat and where at least some of the light is provided by artificial sources and the air flow and temperature are controlled. There is probably more biological diversity and productivity in these spaces than many would assume, but compared to an ancient forest the levels of diversity, and resilience, are orders of magnitude lower. When one moves outside in these human constructed spaces the levels of complexity rise but they still are far lower than in complex ancient natural systems. It is still the case that in most city parks, commercial landscaping, and home landscapes. That one experiences scattered trees, still more often not native species, that are pruned and shaped and cut down and/ or removed just when they start to really offer a diversity of ecological niches, like dead tops, hollows in the trunk and branches, dead wood on the ground, including fallen trunks. In addition, these trees are usually surrounded by large swaths of closely mowed non-native grasses and forbs. There are few shrubs and small trees and ground covers and vine. So it is a diversity of species, structures and age classes that are generally missing. School,

[15] This is when a species that is when a species that comes to a new area is able to reproduce itself without human intervention.

[16] Not all non-native species that naturalize to a new area ecologically diminish native ecosystems, some actually add to over-all diversity and complexity, but note the next passage in the main text. Sometimes there is a lag-time between establishment and when a species begins to become invasive. Also, changes in the environment, especially certain human actions, can create conditions that can allow a normally subdued species to become invasive. In fact, for species to become truly invasive there usually has to a be a severe alteration of ecological systems, loss of complexity and at this scale the cause is overwhelmingly human patterns of interaction with complex systems.

[17] Although in regards to retained eco-complexity Cascadia is relatively better off than many regions of the world.

work and store environments usually provide very little species diversity in again mostly imported species and usually overbred horticulturally varieties that no longer offer many of the ecological benefits that their natural relatives do. In these spaces there are large impermeable, harsh living surfaces in the form of asphalt, concreate, metal and glass, which further reduce ecological function. In an experiential paradox, which all environmental educators must contend with, simplified ecological systems dominate much of the landscape in Cascadia and yet this is a very recent situation, However, due to human life spans, which frame one's chances for experiential learning, these greatly simplified landscapes are what most of the people now living in my home region have experienced most of the time in their lives' and they have far and away the most experience with then systems that have been simplified to the greatest degree.

I think of Von Glaserfeld when he states that from the constructivist point of view the most important element in creating worldviews are the first hand experiences we have in the world (von Glaserfeld 1995). This leads me to think about what it will mean for the world to have so many powerful beings who think simple natural systems are normal. In *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed,* James Scott points out that in a short time these new controlled, simplified landscapes help determine cultural aesthetics for what nature should look like, like for instance, timber plantations instead of ancient forests (Scott 1998), as I had mentioned in my section titled "Visual Corridors". In her own reflections on the state of the Willamette River in, *Meander scars: Reflections on Healing the Willamette River,* Abby Phillips Metzger I feel encapsulates my concerns perfectly. She starts by referencing a famous Aldo Leopold quote, "One of the penalties of an ecological education is living in a world of wounds" (Leopold 1966, p. 197). The more I have learned about the world I am living in the more truth I see in this simple statement. Metzger then contemplates Leopold's reflection saying, "What does it mean to live with so much loss, with only remnant essence of something, the soft edges of a places we can only fill in with imagination and not experience?" I agree with this statement and also the ray of hope Metzger shines when she continues saying, "If we don't know what a river used to be, how can we ever find the courage to hope that it can be that way once more" (Metzger 2013, p. 15)? I feel this line of reasoning naturally applies to the

forests of Cascadia too. If we don't know what forests were like, their natural complexity potential, then how can we hope we might return some of the beautiful magic of complexity? We need to know the story so we know that things are not even in the *range* of complexity "norms"[18] for the region so that we might take action. Of course we need to know the natural history story well if we want our actions to be of maximum effect in helping us reach the ultimate goals of environmental education.

As humans we do need to tell our stories about the world. The challenge is that if our stories more and more involve natural systems that are simplified to greater and greater degrees, and we don't realize this, then stories lose much of their power to foster human understanding of complexity. If we form emotional connections to simplified environments because this is where so much of our lives take place, what will that mean? I think we need to create new stories that involve people working to experience complexity to the fullest that they are able and working to restore complexity into our lives as much as possible.

Higher **Education**

When I came to college I was very happy and excited that I would finally find others who shared my passions for natural history and environmental awareness. My education leading up to college provided very little in the way of studying life on Earth, beyond human life that is. One illustrative exception was an earth studies class I had in eighth grade. I was engaged in this class and excelled, grade-wise, which was a surprise to me and to my classmates since I was not a good student in general. The fact that I had been engaged and excited by the focus of the class made me want to try harder. Unfortunately, this class was an exception in my

[18] These "norms" of course fluctuate across a spectrum, a "range" and in time with changing conditions this range can change, but the timeframes involved in these range changes are far longer than what is occurring now.

educational experience. In public schools at this time there was really no place to further pursue my interests and so I had look beyond formal education and do it myself.

Not very far into my environmental studies program at the University of Oregon, my educational expectations were challenged as I realized that much of what was being taught was review for me. I had already gained much of this knowledge through extensive reading and rich experiences in the ancient rainforests of Oregon. I really had to question the value of higher education in a nation where ecological literacy levels seemed so low that what was being learned was not, I felt, sufficient to rise to the environmental challenges in the region and around the planet.

Despite a relative sense of review, I did have valuable and impactful experiences at the U of O. One of my professors saw my passion for the ancient forests and gave me one of my first formal teaching opportunities when our class took a field trip to the Fall Creek Corridor. Fall Creek had one of the last remaining significant low elevation ancient forest stands in Oregon. The towering trees with their perched “hanging gardens” high in the crowns of these low elevation giants really drew my attention and gave me an eye for recognizing attributes that were most often found in the almost non-existent remaining scraps of low elevation ancient forest. I learning that all ancient forests are different and my understanding that the most complex and productive ancient forests were in general the low elevation forests was reinforced and elaborated upon. In the lab portion of this class, I had my first opportunity to look at a small sample of ancient forests soil under a microscope and with this transformative experience came a realization of where a great deal of the biodiversity in an ancient forest was. Much of it was at spatial scales beyond human sensory perception whether that be microbial life, life hundreds of feet above our heads, or hidden from our sight underground. These experiences gave me whole new nested worlds to explore and to make people aware of, to help them notice.

The Human Element

It was also during my undergraduate work that I really *started* to include human communities and cultures in environmental concerns. I resisted this change, and it would be a long journey to be more inclusive and understanding. I felt that humans, almost all humans, were at the heart of environmental destruction so I did not realize that exploitation of the environment, *and* a great number of marginalized human cultures, went hand in hand. I remember this realization surfacing when I was working on a short environmental history project on the Galapagos Islands. The project touched on island biogeography, the ecologies of the islands, and Darwin's visit. In the research I came across a topic I was not familiar with, the modern human impacts on the Galapagos. At first I wanted to dismiss the people who had come to the Galapagos from mainland Ecuador as destructive exploiters of a protected environment. As my inquiry headed deeper it became clear that most of these people had come to the islands because they were drawn be opportunities to get away from widespread poverty that was largely a legacy of colonialism. The Galapagos held out the promise of things that could help families live more secure lives. There were rich fishing grounds, tourist dollars, and infrastructure built for the tourists. I was for the first time conflicted over an environmental issue. There were not just two opposing sides, those who wanted to exploit and destroy the environment, and those who wanted to protect it; the situation was far more complex. By this time in my life the idea that things were almost always more complex than they appeared at surface level was already somewhat of an educational mantra for me; it still is. Despite these new considerations, my top concern was still for the unique island environments of the Galapagos, which were already far more environmentally damaged than was generally recognized. These new human colonizers seemed to piling on the damage and yet I also felt for them too. This was a very big step for me. I started to realize that social justice, economic justice, basic fairness, and

long lasting colonial legacies made situations regarding huge swaths of complex nature around the globe far more complex than "humans bad, nature good; get the humans out and let nature heal". I did not like that this added complexity made environmental decisions more difficult because it was less clear who to side with. I realized that proposed solutions would have address all the intricacies of these situations. This would mean a longer more complicated process involving more compromise. This troubled me because I was becoming very worried about the amount of time remaining to make important decisions and take actions given the speed at which the forces of simplification were changing the world in profound ways.

It was also at this time in my life that I was gradually starting to find out more about how profoundly the cultural practices of Native Americans had shaped many of the landscapes I was drawn to. Three, out of many, that I had many impactful experiences in are: The Willamette Valley, the Bald Hills prairies in Redwood National Park, in the northwestern corner of California, the seaside, headland prairies of Cascade Head, on the northern Oregon coast, and a mixed tanoak (*Lithocarpus densiflorus)* California black oak (*Quercus kellogii*), canyon live oak (*Quercus chrysolepis),* and Oregon white oak (*Quercus garryana*) acorn "orchard"[19] created and maintained by the Chilula people in the Coast Range of northwest California (Defenders of Wildlife 1998; Underwood, Arguello, and Siefkin 2003; Zobel 2002). This was another huge transformation of my understanding of ecocultural dynamics. As I started to learn more about the ways Native Americans interacted with the living world, and much more about the overlapping field of fire ecology, "Pristine Wilderness" myths started to slip away as did at least some parts of the "Noble Savage" myths I was also holding onto. I feel I should point out here that I am using the western scientific names and English common names for plants species in this project because this is what I know. I am aware that there are many dozens

[19] This was on a property of a professor of mine. Interpreting the natural history story written on the landscape, I figured out that this place had been managed by the Chilula to provide growth conditions for near optimal growth and acorn production in four different tree species. The tanoak (not an oak but in a genus that is an evolutionary bridge between the oaks and the chestnuts) produced the most sought after acorns and these trees were obviously the focus of the most careful management; they were in the most orchard like grove with giant trees relatively evenly spaced and little competing vegetation. Tanoaks would be the most delicate of these species to manage. They are very fire adapted, but the thin bark means killing the mature acorn producing trunks (the tree would then vigorously sprout from its root-crown) would be quite easy without an intimate knowledge of how fire interacted with this species. This place was an illuminative eco-cultural landscape/ethnographic landscape.

of Native American names for each species I have mentioned; a testament to the eco-cultural diversity of Cascadia. In fact, the higher the levels of ecological complexity/diversity the higher the levels of cultural diversity over a given area (Loy, Allan, Buckley and Meacham 2000). These landscapes were the long and complex stories of the interweaving, the coevolution, of human culture and the rest of the living world.

I came to the realization that the qualities of the Willamette Valley that prompted early Euro-American pioneers call this place an "Eden" existed because of the actions of multiple Native American groups over thousands of years as part of a process of co-evolutionary, eco-cultural process I noted earlier. This process was so fine-tuned and precise that it allowed native peoples to adapt with the shifting climate of this region and provide them with a great diversity of plants from northern and southern assemblages woven together with expert manipulation of fire. I was amazed that human actions were actually increasing, not diminishing, biodiversity/biocomplexity. These were humans who were not degrading the resilience of nature systems, incredibly they were enhancing it, this was a revelation for me. Native American cultural practices, here mostly those of the numerous bands of the Kalapuya, had helped shape the land into an ecological mosaic that in form, texture and spacing is generally desirable to the breath of humanity. The idea that this paradise had in fact been shaped by "primitive" peoples did not occur Euro-American settlers, at least not from any accounts I can find. One reason for this was the fact that most Native American populations had been decimated by European diseases and in the Willamette Valley there were very few Kalapuya left by the time most white settlers started to arrive and many parts of the none remained at all (Loy, Allan, Buckley and Meacham 2001; Ramsey 1977). Another reason for this inaccurate cultural world view was that most Europeans did not believe that the "primitive" peoples of the "New World" had the agency to shape the land in profound ways. In his piece, *Buried Epistemologies*, Bruce Willems Braun talks about the, "Colonizing power *inherent* in particular ways of rendering landscapes 'visible'". He goes on to describe how, "Colonial administration made visible a discrete realm called 'nature' that could be seen as separate from colonized peoples, or perhaps more important, how what counts as nature today is often constituted within, and informed by, the legacies of colonialism" (Braun 2010, p. 5). The time I spent at the U of O was productive,

but I find it illuminating that it was not on campus that my most transformative learning experiences of this period of my life took place that they Instead happened in the forest when I was an intern for two ancient forest focused environmental organizations.

Reinhabiting the Ancient Forest, Teaching Transformations: Opal Creek

The time I spent at Opal Creek, actually living in the ancient rainforest, profoundly transformed my understanding of the nature of life and the nature of education. Up until this experience my interactions with ancient forests had been most often on day hikes and less often backpacking trips lasting one to seven nights. At Opal Creek I lived in the ancient forest day after day and month after month and through the changing seasons and the subtle, complex, and temporally variable ecological "calendar"[20] of life in the ancient forest. I had the gifts of time and intimacy in a truly beautiful and intriguing place. Opal Creek is never far from my mind when thinking of ancient forest natural history. In this place I had the time to start to learn to read the stories of fire mosaics, disease mosaics, erosional mosaics, flood mosaics, wind mosaics, herbivory mosaics, human mosaics, mutualistic mosaics all interwoven across broad scales of time, space, diversity, and complexity and displayed in the artistic form of the ancient forest. I came to recognize each ancient tree as a unique individual that told its unique story of many centuries and too many interactions with its environment to even imagine. Also, regarding time, at Opal Creek I really first started to learn that the complex, diverse, and intricate structure of ancient forests, greatly slowed the rates at which many crucial ecological processes occurred. Ancient forests, I learned, profoundly shaped and slowed, the

[20]Like the approximately one week in late summer when the nighthawks would move through and fill the night with their strange calls as the swooped after insects

movement of water from the falling of raindrops into dense multi-layered forest canopies covered in epiphytes to slowly moving through the great "sponge" of organic material composed of the dead wood and organics layers, to the meandering and moderated flows of streams and rivers packed with wood of all sizes and shapes and then on to the wood packed estuaries at the river mouths and even beyond to the beaches, rocky shores, open oceans and distant lands. I also learned that ancient forests decrease the loss of nutrients from the system and that their thermal cover provide by the shade of their multilayered crowns actually slow the speed at which atoms vibrate reducing heat under the forest canopy and in shaded streams and rivers. It also became clear living in the ancient forest that these incredible systems slowed the processes of erosional land movements and the flow of sediment in water bodies. At Opal Creek I came to the knowledge that the great accumulations of biomass in ancient forests of Cascadia had profound impacts on the speed at which carbon cycled in the world and that this had profound implications for climate change. I learned that their complex networks of interconnections made more efficient and speedy the delivery of crucial nutrients/energy through the system and that the complex crowns of ancient trees speed up the rate at which condensation occurs as these towering trees "comb" the clouds and bring to the forests additional life giving water. At Opal Creek I gained a sense of place second only to my home. My experiences were infused with emotion and the memories of those years past are strong and lasting. I came to hope that all people, and in particular all drawn to environmental education, would have experiences as packed with emotion, acquisition of knowledge and personal transformations as those I had had at Opal Creek. With regards to Opal Creek's impacts on me as an educator, I also had a great deal of time in teaching-learning interactions with a range of learners as the head naturalist/educator for Friends of Opal Creek, a non-profit environmental education organization.[21] Many of the most impactful experiences that I have had regarding deep natural history and complexity occurred at Opal Creek and this is the setting for many of my best stories about learning and teaching. At Opal Creek I reflected on my life experiences, in and out of the forest. I contemplated. I changed. I expanded on all that I had learned up until this point. To this day I still use my

[21]Now Opal Creek Ancient Forest Center

experiences at Opal Creek as reference points and touchstones to help me interpret each new ancient forest experience. In reflection, I feel that this life-long process of non-linear assessment, reevaluation, and synthesis is crucial for in the formation of effective and passionate environmental educators.

For a sense of geographic space, Opal Creek is a tributary of the Little North Fork of the Santiam River, which in turn is a tributary of the North Fork of the Santiam, which joins the other branches of the Santiam and flows predominately west into the Willamette River, which flows north into the Columbia, which then flows through its lowest stretch into the Pacific Ocean. When I say Opal Creek I am referring to the greater Opal Creek area, which along with holding its namesake drainage, also holds the upper parts of the Little North Fork of the Santiam River, the Gold Creek drainage, the Battle Axe Creek drainage, the Cedar Creek drainage and at least parts of several adjacent drainages. I think part of the reason I framed the space the way I did had to do with the organizational values and goals of Friends of Opal Creek. The organization was founded with a mission to preserve the ancient forest of the drainage and to use that ancient forest to educate the public, politicians, businesses, and people from land management and environmental organizations of the value of ancient forest and of its threatened status. The reality on the ground was that the ancient forests of this area, and surrounding areas like the Bull of the Woods Wilderness Area, represented small islands of mostly unroaded and unlogged ancient forest in a sea of clearcuts and plantations. In telling visiting public and educational groups about the area, I would do a quick tally of the acres of uncut land in the Opal Creek watershed, contiguous roadless lands, and designated wilderness areas. This number sounded large to them, and to me, but this was in part because the numbers were abstract and also due to certain limitations in human perception capabilities. We certainly can't with our senses perceive all of this landscape at once and yet from a high-flying plane or satellite it is obvious this is an island and a relatively small one in relation to the logged matrix of lands, the "sea". So in at least one way land ownership patterns did bound and define this area.

Much of Friends of Opal Creek's board lived in Portland and the office was down stream on the paved roads, but field education for the organization operated out of a former mining camp built in the 1920's and 1930's at the junction of Opal Creek and Battle Axe Creek. The watershed and education center are in the northern Oregon portion of the West Cascades, a geologically distinct range from the far more well-known High Cascades, that are much older and more eroded. The learning center sits at 2000 feet elevation and the river valley within the wilderness area drops to near 1500 feet elevation. The surrounding mountains rise to 4500-5600 feet. The area is cool temperate and annual precipitation totals at the camp are near 100 inches. In the right upslope areas totals probably top 130 to 140 inches.

The area represented an important, but secondary, trading route connecting native peoples from the west slopes of the Cascades, the Willamette Valley and parts of the Coast Range to Peoples of the east slope of the Cascades and beyond to what is now called central and eastern Oregon. There are a number of sacred sites located in the learning center area and in nearby areas. Not to sound cliché, but it did at times feel like I was walking through a land filled with sprits. Could peoples have deeply experienced this area for thousands of years and not left any feeling behind? Maybe it was my own sadness and guilt or both. I tried to remind myself that many other humans had loved this place too. I wondered if only things that can be measure matter.

Due to mining interest in the area and later due to log truck wrecking curves on the main access road, a significant portion of the area, especially significant for its relatively low elevation areas, remained unlogged well into the 20 century. Many attempts had been made to save this area from logging and after many confrontations and legal challenges most of this area was set aside as designated wilderness. In 1996. The designation happened years after my first visit to the area and three years before the first year I worked for the organization.

My experiences living in the temperate ancient rainforest, a dream experience, uncovered a whole new world of biodiversity for me and actually helped me come to a new understanding of the complexities of

biodiversity. I saw so many species that were new to me and learned out about whole new classes of organisms, like fungal endophytes[22] and saprotrophs,[23]to fit into my conceptualizations of diversity in the ancient rainforests of Cascadia. I had a transformation in terms of my understanding of biodiversity and even my understanding of what a species is was challenged. I also came to understand that the biodiversity levels found in temperate ancient rainforests were far closer to tropical rainforests than was generally understood. I discovered that diversity in temperate rainforests took on generally smaller forms that were less showy and charismatic than tropical forest organisms. I learned that in temperate forests more of the diversity is at the genetic level, that is, diversity within each species. Although tropical rainforests have much higher diversities of tree species, several of the dominate trees species of Cascadia reach taller heights than any tropical species. These species also grow to larger sizes, producing larger volumes of organic material, than any tropical species and they can live far longer lives than tropical species. Also, a temperate forest giant has much longer lasting ecological contribution to the system because when the tree dies it takes far longer to break down than tropical species. The result is that in terms of biomass accumulations[24] and ecologically positive impacts on carbon and water cycling, the temperate ancient rainforests of Cascadia are among the most important living systems in the world. The more I learned the more fascinated, intrigued and passionate I was about these forests. As I took so much in this immersive experience, I caught a glimmer of just how much there was to know and how little I really knew, and again I was excited and invigorated.

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[22] Fungi species that live inside the leaf tissue of most plants. Douglas-firs can have up to seven species in one needle

[23] Non-photosynthetic plants, partially-photosynthetic plants and plants that shift back and forth between photosynthetic and non-photosynthetic depending on changing forest conditions. All species are partial (to full) parasites on the mycorrhizae fungal network that binds the forest together and allows for nutrient flow between plants. The amount of resources they take are minimal and so there is generally minimal impact on the plant species that are sharing carbohydrates through the mycelial web.

[24] Biomass accumulations in these forests are the highest per acre of any known systems; ranging from 2-10 times that of an "average" tropical rainforest. These huge accumulations of organic material also create the conditions for the greatest part of the biodiversity of these temperate rainforests in the incredibly numerous and diverse organisms that through a complex chain of digestion break this immense woody mass into forms that can again be used by plants.

In these forests I really started to understand the mutualistic relationship between many members of the fungal kingdom and the vast majority of the members of the plant kingdom. I realized that without this relationship the forests at Opal Creek would not exist and really forests as we humans know them would not exist anywhere on the planet. This discovery led me to change me general understanding of life from being all about competition to a more complex view that included mutualism a key concept throughout the breath of lifeforms on Earth.

My time at Opal Creek was absolutely filled with surprises and discoveries that have formed memories that I still retain in detail. I remember exactly where I was when I saw a 13- inch- long pacific giant salamander, the largest terrestrial salamander in the world, on a jaunt on an old abandoned miners trail in a mossy corner of the forest. It looked had patterns that looked like the intertwining fingers of two different molten metals hardening in a dendritic pattern on the body of this giant. My fellow naturalists and I saw a trap door spider fold up and pull a large caterpillar down its hole cut into the mossy forest floor, I watched large salmon in pools preparing to mount the falls ahead of them, and I felt the body warmth on the fallen feather of a great grey owl that had just flown. I found a scorpion in my sink in a cool, very wet temperate rainforest at 2000 feet elevation in a pan filled with water it appeared to have drown and must have been under for a long time and yet when I poured the water out outside my cabin it incredibly revived and crawled away. I was astounded to find over thirty species of jumping spiders, one of my favorite creatures, in these forests. Every trip to the outhouse seemed to be an exploration of spider diversity.

It was at Opal Creek that I experimented with making connections across different scales of time and space and across “traditional” dividing lines artificially imposed to create separate educational disciplines. In terms of time it was hard not to contemplate different scales of time with the geologic history of the West Cascades, the geomorphology history of the Pleistocene, the human histories of a succession of native peoples, the mining history, the logging history, the fight for wilderness protection and the shift to ancient forest education all so prominently written on the surrounding landscape. Several things I learned from my

deep study of Opal Creek's complex systems changed deeply held understandings I had of the way the living world worked.

Genetic Continuum of Life and Multi-Path Succession: Transformations in World Views Part 2

My use of time, intimacy, and passionate attention to every detail in the Greater Opal Creek ecosystem allowed me to start to figure out some of the complexities of the ancient forest on my own. I found that when I was able to come to answers to ecological riddles on my own the learning experiences were more impactful, memorable, uplifting, motivating and lasting than when I learned second hand. This epiphany made realize that most environmental knowledge was no longer acquired through direct experience in my culture and yet I felt this was the most efficient and natural way to learn about one's environment. With just a little more thought it dawned on me that of course first hand deep, broad, focused learning in complex environments would foster the best learning outcomes with regards to complexity. After all, this manner of learning and teaching had been the human norm until a relative fraction of a second in the story of human evolution. In fact, it was this way of learning about the living world that shaped the biocultural evolution of humanity, that is of human cultures *and* human biology. Stated another way, to learn in this charged, rich experiential manner is a key element of what it is to be human.

Given time to really explore the forests and interpret the many layers of disturbance mosaics I was able to definitely conclude that the most prominent forest successional models of the time were not correct in their representations of the successional processes in real forests. That is, succession in ancient forests was not a simple, linear progression towards a stable-state climax forest. It was instead a complex series of disturbance

feedback loops and variable patches in a gap-phase pattern that was complex to the point of seeming chaotic to human perception. Given what I learned about the successional models it came as little surprise that vegetation cover maps based on climax vegetation did not accurately reflect the realities on the ground either.

I learned that due to the way my culture divided and delineated land, most maps attempted to cover far too much ground and that in trying to represent all this space on a small map the result was that they were far too generalized and coarse to give enough detail to be of much use in learning about the true dynamic complexity of vegetation mosaics. In addition, most forest successional models had a fair amount of detail up until the point the forest reached the late successional stage and then the table or illustrated representation ended. I knew from experiences in a few ancient forest stands even more ancient than the oldest patches in the Opal Creek area that ancient forests continued to evolve and become more complex for many centuries after initial ancient forest characteristics had begun to appear. These realizations left me confused and disappointed by the ill-fit between these widely distributed and used tools and what I had experienced. These feelings helped push my search for more complete answers. Later I would realize that these simplifications and generalizations reflected strongly-held dominate cultural beliefs and values towards forests and education. My understanding of the intricate natural histories of ancient forests changed in a profound way as did my understanding of how my culture's values were imposed on ancient forests in ways that did not recognize layers of complexity.

In a similar vein of logic, I realized that hierarchical, rigid, and segmented/separated taxonomies of the diversity of life were not accurate and did not represent the true nature of life. For instance, just over the drainage divide from Opal Creek in a north facing glacial carved cirque, now lush with giant, artistically shaped trees, the conditions were just right, cool and wet enough, to allow higher elevation species to come down slope and mingle with lower elevation vegetation. In this place I discovered that western hemlock (*Tsuga heterophylla*) and mountain hemlock (*Tsuga mertensiana*) hybridized under just these microclimatic

conditions. Years later I came upon a paper that said that this was possible and it was a good feeling to have validation of what I had learned. On another trip to higher elevations I found the meandering elevational gradient where Sitka mountain ash (*Sorbus sitchensis*) and Greene's mountain ash (*Sorbus scoupulina*) hybridized above Opal Lake. Here the colors and textures of lower elevation systems shifted and blended with those of upper elevations. I was seeing the genetic continuum as it was, not as a group of taxonomic units walled from one another. Most species here could not successfully hybridize but a good number could and so there were "doors" through which the genetic flow could occur. Also, over biogeographic time other related species could come into contact and hybridize and speciation could occur from this hybridization. This is one common path through which new "species" evolve. These personal discoveries taught me that to grasp complexity I must be able to level jump to many different scales of space and time. On a little moss covered mound-like rock outcropping in relatively open and dry, southwest aspect, forest on the toe slope of Whetstone Mountain, only a little way from my cabin, I found hairy manzanita (*Arctostaphylos columbiana*) and pine-mat manzanita (*Arctostaphylos nevadensis)*, plants of quite different structure and general morphology, hybridizing. What was really amazing was all steps of the genetic introgression were represented with both parent "species" represented and the blended offspring, which were intermediates of the two parent species in every observable trait, present also on this small green stage. In spending great amounts of time examining the details of plants in the forest, and then referring back to my plant guides, I also realized that many of the pictures and descriptions were to some degree looking at a determined ideal for each species. I discovered that in reality within each species there was a great deal of genetic diversity and this explained the diverse forms of many plant and animal species I was observing. These experiences added complexity to my understanding of species and I began to question other things I held true. In a deeper way I came to believe that most things in my world were far more complex than the ways they were commonly described and defined. This major conceptual realignment got me thinking about the underlying motivations and values that had influenced the formations of systems of taxonomic classifications and organizations and this critique and inquiry lead me to question many aspects of western science in general.

This is not to say humans should not classify and categorize it is just that now the values were springing from a set of capitalistic, commodifying values and this has a profound impact on how classification is represented. As I learned these things I wanted to know more and I also felt a great urge and an ethical obligation to help spread this awareness to others.

Being There: Place Based Education

It was at Opal Creek that I explored the idea of how important direct and sustained experience in these complex forests was to moving forward environmental awareness and knowledge. In fact, it was in that magical green place that I started to formulate the idea that without prolonged and intense interactions with complex natural systems that placed high value on understanding the breadth and depth of complexity, a society could not have the levels of environmental knowledge, awareness, and connection to be able to face the global environmental challenge; I still stand by this assertion.

Another key transformation that I attribute to my rich experiences at Opal Creek had to do with the way I teach. In the late 90's and earliest 2000's when I was the head naturalist for Friends of Opal, I, like most environmental educators, believed that if we gave our students and the public the facts and the details about the ancient forests and nature in we gave our students and the public the facts and the details about the ancient forests and nature in general, that this would translate into caring and this would lead towards environmentally positive actions. As one can see from the way I wrote this last passage, at this time education was still widely held to be a unidirectional exchange of knowledge.

In contemplating the value of first-hand experience with complex nature in the form of ancient forests, I am reminded of some words that Kathleen Dean Moore wrote in the forward for Oregon Wild: Endangered Forest Wilderness. She talks about a journey down a path into a wetland where a complex web of natural associations was still intact. She says, "I had forgotten. Accustomed to the stripped down and hacked

habitats at the edge of town, I had forgotten this richness and complexity, the wholeness of an intact ecosystem." She goes on to say, "If we no longer know healthy, beautiful habitats, our standards for of natural health and beauty slide down to meet the degraded landscapes that we know. "By showing us a vison of what we have destroyed in our daily lives, wilderness is a standard by which we can measure our loss, as it is a standard to measure our hopes" (Kerr 2004, p. xi).

In reading David Orr's, "What is Education For: Six myths about the foundations of modern education, and six new principles to replace them", I found that he and I share some of the same concerns about *how,* and *where,* education takes place. Orr says,

> "I would like to propose that *the way learning occurs is as important as the content or particular courses.* (Emphasis in original) Process is important for learning. Courses taught as lecture courses tend to *induce passivity.* (Emphasis is mine). *Indoor classes create the illusion that learning only occurs inside four walls isolated from what students call without apparent irony the 'real world'."* (Emphasis is mine)

Several other authors talk about the limitations of teaching in simplified, low stimulation environments, and even mention classrooms in particular. I implore educators to think about all the lessons that are being taught purposely and those that are taught implicitly, and which are actually more impactful given current experiential possibilities with regards to complexity and cultural values regarding natural complexity. This seems to me a call to teach in complex, stimulating environments and ancient forests are exemplary in these aspects. I am not saying teaching in classroom environments has no value. I am saying that there needs to be the addition of many more opportunities to learn in complex natural environments.

The idea also really started to form here that the culturally dominate "formal" model of education was a very powerful confounding factor when it came to implementing and spreading the kind of education I knew, more and more every day, was necessary for environmental education to have a chance to achieve its ultimate goals. In, *A Foucauldian Analysis of Environmental Education*, David A. Gruenewald says, "I argue

that environmental education will be ineffective in advancing its own goal of creating an environmentally or ecologically literate (Orr 1992) citizenry as long as it continues to discipline itself within the norms of general education" (Gruenewald 2004). I believe that Gruenewald's argument is still unfortunately very valid today, more than a decade after her wrote this piece. Gruenewald further asserts that since environmental education depends mostly on science and classic environmental thought it, "tends to neglect the social, economic, political and deeper cultural aspects of the ecological problem." I would say there has been significant progress this point, but much still needs to be done. The more holistic approach that Gruenewald advocates essentially mirrors my holistic natural history approach towards ancient forests. I realized that the narrower "traditional" natural history approach, which focuses with almost exclusively a scientific lens, did not reflect the world and would not be able to have enough impact with regards to expanding how learners understood ancient forests. Ancient forests, like everything else, were not places where scientific principles occurred in isolation from social, philosophical, political, economic and psychological factors in society. So given this reality, I propose a (w)holistic approach to environmental/natural history education that recognizes and reintegrates these factors into thinking about how to help in the process of educating with the goal of solving broad environmental challenges. An example of this applying this approach might be choosing a particular ancient forest and having numerous visits in which everyone in the learning community is encouraged to share their perceptions, ideas, observations, interpretations, and stories of this place. As a facilitator I would make sure to encourage the rest of the learning community/commune to think I terms of experiential, transdisciplinary and deep inquiry learning. Where I felt it necessary, I might give prompts to help expand the scope of our exploration across traditional discipline boundaries and beyond dominate cultural discourse frames. After several visits and time for sharing, discussion, and collaboration, the group might create an educational artifact to attempt encapsulate the experience and what was gained from it. This might be a paper, a play, an artwork, an interpretive guidebook, a song, a story, a lesson, a curriculum or something suggested by a group member I have not thought of.

My experiences in colleges and universities have led me to strongly agree with David Orr's assessment in, "What is Education For", that higher education has become a very profitable business. I would say that most education is squarely in the sway of dominate capitalist values that largely define Western Culture. Since, as I have stated, these values run completely counter to goals of resilience and sustainability, it is hard to see how the level of progress needed in broad environmental thinking is achieved.

An example would be university investments in fossil fuel entities. Yes, a divestment movement is afoot across many universities, but it is late in coming and many, many educational institutions still are invested in patently unsustainable resource use and I would argue this creates a clear conflict of interest, especially within environmental education programs. Another example of this phenomenon would be "private corporate partnerships" between universities and a range of corporations with goals that often directly conflicted with the stated educational goals of higher learning institutions. I think there is growing recognition of this situation but much of this influence is subtle and so ingrained that at many levels it slips by unnoticed and unchallenged. David Orr illuminated this situation in 1991 in, *What is education for* (Orr 1991) and again in his book, *Ecological Literacy* in 1995 (Orr 1995) and yet the influence of capitalistic worldviews on colleges and universities certainly is not waning. Part of the reason for the persistence of this influence seems to be desperation for funding on the part of many institutions of higher learning due to the fact that many state and federal sources of educational funding have been reduced or eliminated in the United States. This forces many schools to seek "creative" funding solutions. I feel this forces places of learning to cloud their values believing the ends justify the means and claiming that the values of their funding sources will not influence their educational values and goals. I fear that the idea of making drastic changes to cultural values is very daunting and so many will not choose this path. This is not to say that there have not been successes in this mission, and there will be more, but given the speed at which capitalist thinking applied to living systems reduces resilient complexity and given the nature of ecological tipping points, where feedback loops engage and/or intensify, it does not seem at all likely that under a values system that even significantly resembles the current dominate model that the amount of change needed will occur within a timeframe

bounded by the realities of Earth's ecology. The absolute highest levels of educational efficiently are absolutely necessary at this point in natural history and this is why I feel that we need to look to the foundational components, including perceptions of time, of human natural history education that have sustained the human species through a long evolution. I believe that experiences at places like Opal Creek have been critical to humanity and now they are urgently needed more than ever.

Seeing for the First Time

My experiences at Opal Creek were far too rich and expansive to fit within the limitations of this paper. This seems to be just part of the "territory" when it comes to complexity education. One particularly profound experience that I had as an educator at Opal Creek has helped shape my understanding of direct experience and emotion in environmental education in ways that I still use every time I teach and learn.

It was a hot summer day and a group of young people were working down in the Willamette Valley on the Oregon Garden project as AmeriCorps volunteers. As a reward for their hard work, they were going to visit Opal Creek. I was asked to give them an educational tour. From the beginning it sounded interesting, but I did not know there would be such lasting impact from this one encounter. These AmeriCorps volunteers had come mostly from economically disadvantages areas of larger cities: New York, Los Angeles (Compton), Cleveland, Cincinnati and I was very curious as to how they would react to Opal Creek. When we hiked in from the trailhead and they got their first good view of the sublime waters of the creek cupped in the verdant, vibrant green of the towering forest, they were simply amazed. That they were very surprised by the landscape was evidenced by the fact that many of them kept saying that, "I did not know anything like this even existed". Think about that, they had never even seen a picture of place like Opal Creek or heard someone describe such a place. Watching their wonder and surprise made me see these forests I loved in a new way; I wondered what it would be like to experience these forests for the first time when their existence

was totally unexpected. There was no fear of the unknown in the group, and they actually quickly started asking all kinds of questions about the ecology of the area. Why is the water that blue-green color? Why is there so much water, is it here year round? Why is the forest so shaggy? How do the trees grow so big? There were so many other questions and observations and obvious passion and joy that it just seemed that this kind of exploration was natural, that it was in human nature. Of course anyone choosing this kind of AmeriCorps project might be more predisposed to this kind of learning, but how could they know this when they did not know that such a place of learning even existed in the world. In particular, a young African-American man seemed to be a natural naturalist and he rushed through the forest with great excitement and delight exploring every nook, asking questions, formulating ideas, and showing me things that he wanted to know more about or that he just wanted to share with me. Near the end of their visit I took them to a beautiful deep, clear pool beneath a waterfall and we swam in the cool, clean waters. I think about them often. I very much hope the experiences these students had have had a lasting positive impact on their lives' as it certainly has for mine.

In reflecting on this memory, I now realize that it was the very strong emotions of joy, excitement, wonder, curiosity, and the quick sense of community and camaraderie that we formed over our shared emotional outpouring and inward contemplation that has made this memory so lasting. Lasting enough that I can recall the experience in such detail a decade and a half later. In reflecting I always feel the joy again and I also see new facets of this socially mutualistic experience. I feel that it is essential that educators have time and the desire to reflect on their past and their story and the events that have made them who they are and to gain new insights from past experiences through evolving lens of understanding. It is through this process of experience and reflection that I think we gain wisdom. The wisdom to appreciate time and to see how the past informs the present and the future. I deeply believe that experiences in an ancient forest filled with surprise and many other deeply binding, memory creating, transformative emotions connect us to complex places and to each other, it's the human way or the way of being human.

At the time of my experience with the AmeriCorps group I thought the knowledge being gained was the most important element of this interaction, that was my educational focus and I was more narrow in my focus at the time. This is not to say the knowledge was not important, but as I indicated, it seems that it is the memories of the emotions stoked by the experience that are more intense and lasting. I was raised with Western Science and one thing that was clear was that emotion had no place in scientific inquiry. To be honest, I was afraid to even mention the possibility of including an examination of the role of emotion in environmental education in my project because I have been so culturally conditioned to dismiss and marginalize feelings. Emotion, it was said, "Would banish the objectivity that was key to good science." Setting aside that true objectivity is not an attainable goal for a human, I now know with certainty that facts alone will never be enough to make people care about protecting places like Opal Creek. I was already starting to question this philosophy of excluding emotion at the time of this experience and now it rings truly hollow. This is not to say that emotion is always a positive force in the understanding and valuation of complex nature. Uninformed emotion and emotion too strongly tied to certain values sets can be very harmful to these goals. Look at the mixed impacts of the high emotions during the "spotted owl/timber wars" for example. I would guess that the emotionally charged politicization of science pushed many scientists to shy away from looking at emotional aspects of environmental problems. In addition, there is of course the western scientific tradition of dispassionate, detached, reductionist and mechanistic world views that also marginalize emotion.

When we look upon a beautiful natural scene we have an emotional response. Overwhelmingly it is a positive response. When we come upon a place where humanity has damaged, simplified, nature many of us will have a negative emotional response, like when I saw the landscapes beyond the visual corridors. I would say that these guiding emotions extend very far back into hominid evolution. I would argue the dominate Western culture has hijacked these emotions to make feelings about world based on very different values and motivations. Some might argue that this is a deeply subjective assessment and that there should not be judgements made about the ways in which cultures evolve. I can see this point, but I would counter by

pointing out that emotions manipulated in this way are used to legitimize, justify and perpetuate a way of interaction with the complex world that is wholly unsustainable to the extreme point where human evolution may be cut short.[25]

When I visited Opal Creek a few years after my last position there I received a further lesson about the rigid, potentially damaging, and culturally entrenched nature of the boundaries imposed in the form of learning disciplines. I met a naturalist who had a great knowledge of the plant and animal species and ecosystem communities of the area and we had great discussions. During one of these I took the conversation in what I thought was the natural direction towards the geology of the area. In particular, I focused on the formation of the rocks that were literally the bedrock for these living systems and the geomorphological history of the area, with a particular eye to the glacial history. My friend rather abruptly stopped the conversation and said "I don't know anything about that" and he questioned why a naturalist would or should know anything from the discipline of geology. I was a little stunned, confused, and concerned. I realized that holistic/whole systems thinking was still despite a lot of talk was still a marginal world view in my society. Specialization and even hyper specialization were still the rule. I can say that since that time progress has been made in spreading a more holistic, transdisciplinary, approach to education, but there is still much work to be done and truthfully little time to accomplish this work in.

So as natural complexity educators we must help to foster educational cultures, educational communities that encourage the expression of emotions the open experiencing of emotions in complex natural settings. Complexity should *feel* good again and we should not feel afraid or embarrassed to share our emotions or to even allow ourselves to acknowledge them internally.

I am reminded of another time when I went to speak to several members of NSEA (Nooksack Salmon Enhancement Association) about the importance of ancient forests in the lives of the iconic salmonids of

[25]"Cut short" in a relative sense when considering the average "lifespan" of a mammalian species, which is around six million years before they become a different species, which can be somewhat ambiguous, or the go extinct.

Cascadia. I told a hypothetical story of a group of native peoples in this area and an ancient Western red-cedar and how this tree could be a living cultural touchstone connection to many, many generations through shared experiences through time with this tree. What if in times of emotional turmoil groups or individuals visited this tree to seek wisdom, peace, or perspective. As I was finishing this story I noticed that several of the people I was telling this story to had tears in their eyes. This was powerful, this was passion, this is what is needed in a situation as perilous as now exists on planet Earth. I set this story in this place and with a tree that grows here, but I could have also talked about an ancient Germanic tribe and an ancient oak tree bedecked with mistletoe, a symbol first of peace and then love (Matthews 1999). It have been a massive *Cyrptomeria japonica,* Sugi in Japanese, wrapped in colorful prayer bands, or a massive Jarrah, a eucalyptus of Southwestern Australia, one termite and fire hollowed branch playing the rhythmic hum of the dreamtime as a digeridoo, or an awe-inspiring Deodar cedar, its very name meaning tree of the gods in Hindi, which like the western red-cedar, and so many of other trees gave to humanity so many things crucial to their peoples that they actual shaped their cultures and were in turn shaped by these cultures. The relationship between humans and trees has existed for as long as humans have been human and in a true genetic lineage sense for far, far longer than that.

In their book *Figments of Reality: The evolution of the curious mind,* Steward and Cohen,

> "Realize that although they know that our scientific instincts tell us that the real universe out there is actually far more important, on any serious scale of events, than whether Mary told her mother she was dieting ... but somehow questions on the level of Mary's diet take up much more of the scientist's time than the whys and wherefores of galactic superclusters – even when the scientist is a cosmologist." (Stewart and Cohen 1997)

The reality that I think these authors reveal is that it is the personal that is most important, that takes up the conscious part of our mind most of the time. As the environment is now culturally abstracted it is hard to make the health of the environment a personal issue. In a culture of low levels of ecological literacy (more on

this later in the project) when environmental impacts are felt personally their causes can be misattributed to less abstract, more salient factors in one's life. This idea certainly fits my experiences and this is why I say we need to bring environmental education into the "real world" of every-day life, where most people spend most of their time physically and mentally.

Ground Truth: Oregon Natural Resources Council

My other impactful internship was for the ancient forest focused environmental organization, the Oregon Natural Resources Consul (ONRC)[26]. One of my primary jobs was going out with a partner to ground-truth remaining roadless patches of ancient forest in Western Oregon. This exercise made me aware of the fact that representations of space on maps and real experiences on the ground can differ greatly. We were seeking the natural history story of the forest and comparing this to maps that were being used for forest management. In personally experiencing these map bounded areas, these creations of mapped space, I was further convinced that maps could only convey very rough sketches of some aspects of reality and yet my culture depended on maps to delineate and bound so many spatial aspects of life. Of course in part how accurate or inaccurate a management map was depended on the valuations of forests held by creator and users of the map. Looking back on this enlightening experiential and exploratory opportunity, I am reminded of a quote by Alfred Korzybski, "The map is not the territory" (Sabbadini 2013, p. 44). I realize that I may not be using this concept in a way that completely fits Korzybski's ideas and that I am applying this to my own experiences to make my point. Korzybski focused on human limitations to actually perceive and define the world around them. I am using an example of physical maps and then using Korzybski's ideas on "orders of abstraction" to show how

[26] Now Oregon Wild

inadequate maps can be in conveying complexity of an ancient forest and certainly in conveying the potential for emotional connections and surprise and excitement. To quote Korzybski regarding the perceptual limitations of humans, “These [perceptions] sometimes mislead us about what is the case. Our understanding sometimes lacks *similarity of structure* with what is actually happening.” To give an idea as to what might motivate someone to nudge mapped representations in particular ways, I would mention Nancy Langston’s ideas about the way people envision landscapes in her wonderful book, “Forest Dreams, Forest Nightmares: The Paradox of Old Growth in the Inland West”, when she says, “People will always look at the land through an idealized vision of what they want from the land” (Langston 1995, p. 333). How we see the land, shape the land, map the land, and name the land all have to do with what it is we want to get from the land. So it seems values can inhibit the ability to perceive eco-culturally resilient realities or they can enhance them.

My work at Opal creek and with ONRC brought my focus to complexity and diversity through a pursuit of field based, holistic environmental/ecological education conducted in the ancient forests. I am aware that that paring the words “holistic” and “focus” in western cultural may appear oxymoronic since focus is usually associated with specialization, but we teacher-learners must retrain ourselves to focus on the complexity of the whole.

Coming to Complexity

I had a pleasant surprise when I started reading the literature regarding complexity education.[27]The language, the structure, and the concepts are very familiar to me. Davis, Sumara, Luce-Kappler and Clarke and Collins and others talk about the fact that complexity education relies on the terminology and many concepts of ecology and since this is where much of my background lies it seems a natural fit for me. In fact, most of the suggested methodologies and techniques are ones I had already adopted through a process of experimentation, feedback, and assessment. So I am an obvious supporter of a complexity focus in education. I use the broad term "education" instead of "environmental education", because, like David Orr, who I would say embraces complexity, I consider "All education to be environmental education" (Orr 1991, p.5), since natural complexity of the environment that makes possible life as we know it.

I feel that first I should clear up a cultural bias with respect to theories of complexity. The key concepts of complexity theory were recognized in western science generally in the mid decades of the 20th century. These concepts were used to describe, and categorize, a number of phenomenon that did not behave like simple or complicated phenomenon; the two categories into which all phenomenon were placed at the time (Clarke and Collins 2007). Although the term complexity theory was new and the terminology within its study was new, the core ideas and concepts of complexity theory have been an essential part of humanity as long as there has been a humanity. The story of the re-discovery of complexity based education is just one example of a common cultural phenomenon in the industrialized world. In a world dominated by Western culture, where reductionism, simplification, commodification, and specialization are privileged, it seems that people are almost constantly re-learning concepts and facts that are part of the human evolutionary heritage. If you brought people from cultures outside of the industrial/capitalist culture, from the current day to almost any-time in human evolution, and told them about the ideas that things are more complex than the appear and things are not predictable and yet they produce recognizable patterns, they might smile, laugh or

[27] The blending of complexity theory, complexity science and education.

shake their head and say something to the effect of, “Yes of course that is the way the world works. You have just figured this out?” The conceptual framework that Western culture has chosen to call “complexity theory” is the backbone of so many belief/value structures as to be *almost* universal in the human experience, by whatever name it is given and whether it is consciously acknowledged or not.

The early story of complexity theory is very similar to the stories concerning the creation of other educational disciplines. In each of these narratives there is an effort to delineate and justify each field of study as its own discipline. In the dominate culture this is a powerful way to gain credibility and yet it should be obvious that this way thinking undermines complexity education. Dominate cultural beliefs and values, or maybe “dominating” would be a more accurate term given the extreme concentration of power, still run counter to complexity embracing worldviews and efforts must be made to at least moderate these aspects of Western culture. The cultural narrative framing of “discovering” complexity theory does not recognize that these concepts are beyond ancient and so this framing serves to marginalize the myriad peoples who have guided their lives through these concepts and it serves to reinforce the supremacy of Western Science. I feel that this culturally shaped depiction illustrates some of the cultural bias, hubris, hierarchical/colonizing domination that prevents Western culture from recognizing, embracing, and benefiting from the resilience that complex eco-cultural systems provide. For this reason, I am trying to help in the process of bringing complexity theory back where it belongs, the study of complex nature on which everything thing else essential to life rests.

To be as effective as possible regarding this goal I feel that the culturally dominate ideas about learning environments must change. With regards to what makes a desirable learning environment, several complexity authors write about the limitations of teaching in simplified, low stimulation environments, and even mention classrooms in particular (Davis, Sumara, and Luce Kappler 2000, 2008). I refer back to the selection from David Orr’s, “What is Education For”, and implore educators to think about all the lessons about complexity that are being taught purposely or implicitly through the choosing of learning

environments. To me this all seems to be a call to teach in complex, stimulating environments and ancient forests are exemplary in these aspects and this section reflexively reinforces the ideas I put forward in my section titled “Being There”.

One important distinction between my experiences and the experiential accounts of Clarke, Collins, Davis, Sumara, Luce-Kappler, Aoki, Pinar is that the vast majority of their educational experiences occurred in classrooms, which are spaces/environments that reinforce dominate cultural values by design; most of the authors acknowledge this in their works. By contrast, the vast majority of experiences that brought me to teach the way I do came from teaching in complex natural environments, especially ancient forests. With the passage of years, and me with a greater depth of experience, I came to strongly believe that it was of course natural to be teaching the complexities of biodiversity and natural history in complex environments that imparted far more than pictures or words could and in fact greatly aided any words spoken in those places.

In fact, in time I came to believe that teaching environmental studies in simplified, and therefore relatively unstimulating learning environments was in fact possibly doing more harm than good, or at least far less good than is generally assumed, because of the larger experiential lessons, usually unacknowledged, that were being taken away with regards to the role of natural complexity in “real”/everyday life. David Orr is a great advocate for deep education, I would argue holistic-complexity education, and someone who has influenced me greatly. I will take another look at a key passage from Orr’s 1991 essay, *What is Education For: Six myths about the foundations of modern education, and six new principles to replace them.* In my section titled “Being There”, my emphasis was on the impacts of *where* learning occurs, in what kind of learning environment. I am reinforcing that argument here, because it is so central to my project goals, but I am also looking more at the passage where Orr states, “My point is simply that *students are being taught in various and subtle ways beyond the content of the course”* (Orr 1991, p. 7). (Emphasis Mine) I am curious about *what* these lessons that are beyond the content of the course are students are and the *impact* of these lessons.

I would add, and I am quite certain Orr would agree, that in many cases what students are being taught in these “subtle, underlying ways”, actually runs counter to the goals of the courses being taught. I would say this is especially the case within environmental education classes. So in these classes students might learn about the complexity of the natural world, but the idea that the natural world is an abstract concept would be reinforced, even though that is not the intent of the course at all. The learning environments don’t lie with regards to reinforcing dominate cultural values and worldviews. I had a personal transformative experience with this concept when I was a T.A. for a large freshmen lecture format environmental studies class that was held in a large windowless room with stadium style seating to accommodate a large number of students. This was not the first time I had pondered the effectiveness of teaching an ecology based environmental studies class in such a sensorial sparse learning environment, but it was the first time I pondered if unintentionally the students were having the idea that environmental education and education in general were tangential at best to real everyday life. I also wondered whether the class content or this powerful place based lesson was having the most impact on students. I have met so many environmental educators, advocates, and professionals that spend most of their time indoors, often at a desk staring at a computer screen, this is unbalanced. How do we possibility expect this to work? All of these layers of abstraction when abstractions from nature leads to environmental catastrophe for a thinking species like humans. Given human potential to be incredibly powerful ecological forces, the more we are abstracted from the resilient complex systems of the world the more damage we will do, even to the point of driving only the sixth mass extinction event in the natural history of Earth.

So why focus on complexity? Well, to expand on what I have said earlier in this paper, complexity is the most accurate way to assess the reliance of the eco-cultural environments. Given enough time, space, diversity, and mutualistic relationships, high levels of complexity form. High levels of complexity provide high levels of resilience, and importantly for humanity, high levels of resilience open the possibility of human sustainability. Again, given the many attributes that make humans a very unusual species of life, sustainability is always in question. Humanity must always pay close attention to signs which show relative health of the environments

in which humans live, which now span the globe. So if sustainability is the ultimate test for humanity than surely helping human populations most disconnected from the true importance of complex nature should ultimate goal of all environmental education, activism and advocacy.

Davis, Samara and Luce-Kaplar, in the three editions[28] of the *Emerging Minds* series, have done a comprehensive job of bringing the elements of complexity study to education. I see it as just a natural move to take this educational focus on understanding and embracing complexity into the field. Being that the ancient forests of the PNW are some of the most complex systems found on Earth they optimal environments in which to provide educational experiences that are rich, that encourage deep inquiry, that provide many surprises and, it is hoped, will provide moments of transformation throughout the learning collective. In "Emerging Minds", Brent Davis, Dennis Sumara and Rebecca Luce-Kappler point out, "That [human] nerve cells run in *both* directions between the brain and the sense organs-and there is more communication *from the brain to the sense organ* than *from the organ to the brain*." (Emphasis in original) They go on to say, "…Sense organs actively fish for sensation" (Davis, Sumara, Luce-Kappler, p. 4). This makes me wonder what do the sense organs seek that provides desirable sensations? In addition, if, as the authors purpose, perception is a matter of imposing expectation on experience, then what is the mind-sensory system expecting to find? The answer to what we are seeking and what we are expecting, I would argue, is complexity. Since humans are complex composite[29] beings, evolving in a complex natural world, it seems only *natural* that we seek out complexity and be rewarded with evolutionary fitness in finding the myriad shades, levels, and layers of complexity in the seemingly endlessly intricate world we live in. I would argue also that ancient forests are, in their incredible complexity and diversity, ideal places to seek and find the sensations human learners are seeking, even craving. Referring back to my AmeriCorps experience there was

[28] Even though the authors chose to call each book an "edition" I would argue that given the amount of new material, from new research and new experiences had by the authors, I would really call each "edition" a volume in a series. This type of reflection, adaption, re-assessment and revision fits very well into the complexity education philosophy, and the authors make note of this and give some explanation

[29] We humans think of ourselves as discreet organisms and yet we are maybe more accurately a mobile ecosystem made up of a huge diversity of organisms from several kingdoms of life bound together by mutualistic relationship bonds without which the human, and undoubtedly other species in this ecological amalgam, could not survive.

something, I would say deep complex sensations, missing from the lives of these learners and when they came to that incredible forest, which was orders of magnitude more complex than the cities they came from and self -organizing and self-sustaining, their sensory self and their mindful self naturally, happily and excitedly embraced the environment. As a professor of my mine said these young people probably always sensed something was missing in their lives. I fully agree and would add that I felt that when they got to Opal Creek they knew they had found what had been was missing.

Davis et al go on to say that, **"**Learning new things … is largely a matter of conscious awareness", and that, **"**Even in the most austere and focused settings, sensory organs are active" (Davis, Samara, Luce-Kappler, p. 8). "Austere" and "focused" sounds like most Western classroom settings to me although I take some exception with the use of "focused" since there seems to be an implication that focus must be narrow as one would expect in a greatly simplified and controlled environment, like a classroom. Well maybe the implication is not that focus has to be narrow, but that in the classrooms of "western" education it almost always is. I would argue that in these reduced settings the highest levels of stimulation cannot be reached. As I have asserted before, but I feel it needs repeating, these simplified environments can actually reduce the effectiveness of natural complexity education. By teaching in simplified environments educators, usually unintentionally, take learning, about complexity and abstract, isolate, and separate it further from "everyday life". (Aoki 2005, p. 5) Everyday life is most of the time in our lives, what many might refer to as "real life" as opposed to the somewhat isolated and abstract academic world. This way of teaching implies that natural complexity does not really apply to real life and so it need not be something one thinks about most of the time. To give more weight to this idea, Davis et al say, "Research shows that concepts learned in this simplified and isolated manner are often difficult to connect to events outside the classroom." They also explain that lack of rich complex stimulation can actually degrade the efficiently of our neural networks. The authors go on to say that concepts so learned are most often associated with inactivity, abstraction, fragmentation and uncomfortable seats. To interpret this last statement: high mental and physical activity together is what we seek as educators and as humans, abstraction is something we have to fight The

authors state, “That perhaps the most critical insight here is that intelligent”, I might say sustainable, “Behavior relies on complex experience and that the inverse is that a deprivation of sensory engagement will lead to underdeveloped abilities to note relationships to predict, to act-in short, to perceive.” (Davis, Sumara and Luce-Kappler 2000, 2008, p. 44.)

Warren Weaver, who did some of the first work, in the “Western World”, to describe and categorize the observable phenomenon of a complex world. He noticed that some phenomenon did not fit into the two accepted categories of the time, simple and complicated. He called these phenomenon “organized complexity”. Weaver pointed out that in organized complexity phenomenon involve a huge number of variables and although the outcomes of these phenomenon cannot be predicted they are not completely random; patterns emerge, given enough *time,* thus they are to some extent “organized’. To me this is a great description of key elements of the natural histories ancient forests of Cascadia. In fact, what Weaver “discovered” helps explain a concept I call the “ancient forest paradox”. The “paradox” is as follows: all ancient forests are unique and yet all ancient forests have attributes that unify them as ancient forests. It is both the uniqueness of each forest and the things they hold in common that make them so important to ecological resilience. Maybe it cultural condition that makes this concept seems potentially paradoxical; standing in an ancient forest it makes perfect sense. The unpredictable, always unique, and yet patterned nature of complex natural systems allows for so many unique paths of inquiry in so many unique minds shaped by unique experiences of the world; in this way an ever deeper understanding and valuation of complexity can be fostered. By telling our stories of our, we in the learning community, experiences we can make an often abstracted environmental crisis I feel more real, more relevant and salient in our lives.

I think I should deconstruct my use of the term “paradox” by noting that I have found many other seeming paradoxes in my cultural perceptions of complex nature, so many so, of such profound weight, that I have come to believe that a human population that is largely disconnected and non-knowledgeable about natural complexity is a true the paradox. It is a paradox that must be resolved either in the positive reshaping of

world-views into accurate sustainable views or in global environmental collapse. I understand that I am using a dichotomy here, even though they are almost always false, but in this case I can't envision another possible outcome.

According to Clarke and Collins, Weaver came up with the concept of organized complexity to explain a large middle ground the lie between the dichotomy of simple and complicated phenomenon (Clarke and Collins 2007). I think that this idea is complimentary to Ted Aoki's ideas that the middle spaces, the "ands" between supposed bounded categories and between bounded languages and nations is the place where true learning happens. These are the places of highest complexity. To expand on this idea, I would say these are eco-cultural environments of hybridization and shifting mosaics; ecotones in a sense stretching the word to its fuller potential (Aoki 2005). In rich eco-cultural environments there are many overlapping and layered zones of hybridization where cultures and genetic lineages blend and shift and the true nature of life becomes just little bit clearer.

Of great relevance to my educational approach, Weaver observed that Complex phenomenon, like complicated phenomenon, have many variables but the outcomes [unlike with complicated phenomenon] are rarely predictable." I would say that this is a good description of the cycling of ancient forests. As I have explained, my experiences at Opal Creek, and many other ancient forests, convinced me that succession in ancient forests is non-linear and very complex and because of this nature in which these systems change these systems contribute greatly to local and global environmental resilience. Even in a small area of an ancient forest over a short period of time, short even on a human timescale, the number of interactions swirling is truly mind-boggling. As former National Forest chief and scientist, Jack Thomas, pointed out, "These [ancient] forests are not only more complex than we think they are more complex than we can think." Thomas puts in perspective the value of this complexity when he continues, "There is little doubt that much of the biological diversity of the Pacific Northwest is associated with late-successional and old-growth forests" (Kerr 2005, p. 27)

The natural histories of ancient forests display all the elements and importance of complexity in a beautiful expression of life. Clark and Collins continue with Weaver noting that that although the outcomes of complex phenomenon are rarely predictable, "…Weaver observed that when outcomes emerge they are not random but display a unique pattern." Weaver is laying down some of the groundwork on the concept of emergence with his work. Complex phenomenon have inherent unpredictability about them but at a critical point, referred to as 'emergence', display a clearly discernable pattern" (Clarke and Collins 2007, p. 5). Any substantial amount of time spent in an ancient forest yields many opportunities to study emergence in forest ecology and in human thought.

Clash of Values: Philosophy in Environmental Education

During my undergraduate work I had a friend who was a philosophy major. One day he and I were talking as we walked across campus and in a self-riotous and self-important way I said, "All you philosophers ever do is talk, you never get anything done." I was an environmental studies major and I felt I was doing important things. My friend quickly retorted, "What do you mean, all environmentalism is philosophy." I was stunned, surprised, I had no comeback, I did not even argue for argument's sake, I knew that he was right and this moment was transformative. The way I perceived the world became more complex, yet again. Years later, I was talking to a professor about environmental education and in the spirit of good humored ribbing he said, "Stop talking so much like a philosopher". At that moment I realized, "I am a philosopher". Had I been a philosopher and this was the first time I realized it or had philosophy become more important to me? I find it

funny, considering what I said to my philosopher friend, that now I make such great use of philosophy in teaching and learning.

I have examined my culture for many years and from as many "angles" as I can think of and time and time again I come to the question of whether a capitalist culture can be sustainable. When I lived in the redwood region of northwest California, I had a series of discussions on this topic with a professor I admired, he had been contemplating this question for far longer than I. We both came to the conclusion that the answer to the question was "No, a capitalist society cannot be sustainable. Too many of the core tenants of capitalism run counter to resilient natural systems. Someone might argue that there are different forms of capitalism or that capitalism can be tweaked towards sustainability. I would answer that even a form of capitalism adjusted so would still not be responsive enough to deal with environmental challenges.

To make the changes necessary would require such a philosophical overhaul that I believe it would really be inaccurate, and/or disingenuous to still call it capitalism. A foundational principle of capitalism is "continuous growth" in a finite world this is an impossibility. In addition, this continuous growth means that rates of resource extraction from complex natural systems is also always accelerating which means that the chances of ecological overshoot are also becoming greater. Capitalism is also driven by competition that is spurred by an unequal distribution of resources and this increases pressures to exploit natural resources at a rate at which the cannot possibly be renewed on anything approaching a human timescale. One could argue without these, and other unsustainable worldviews, it would no longer be capitalism. Even the vast majority of countries that are capitalistic tempered with a large dose of socialism are nowhere close to living in manner that can be sustained beyond a very short period of time. I would emphatically propose that capitalism is the dominant belief system, even faith, in United States. "Invisible hand of the market", "continuous growth in a finite world", are you kidding me? Seriously if these ideas weren't so incredibly dangerous they would be very humorous. These must be articles of faith because logically they make no sense. I would further argue that capitalism is the most powerful faith in the world, despite claims to the contrary about state religions

and culturally dominate religions. Capitalist systems do not stand for any competing belief systems and certainly no belief systems that impede physically, morally, or ethically the ever growing process of making commodities out of every part of the natural complexity of the world. If proof is needed for this last point just look at what global capitalism has done to the many aboriginal peoples of the planet. Given that capitalist thought is so entrenched in my culture I do not know what realistically can be done, but I do know that something substantial will have to be done to shift beliefs away from this system that practically ensures environmental collapse, in the near future at the fanatical levels of belief in this philosophy that predominates at least in the highest echelons of power in a society were power is hyper concentrated in the elite classes.

Many of the world's native peoples, including a great number of peoples of the PNW, have for some time been speaking out against values that lead to actions that cannot be sustained, but so often their voices and credibility are marginalized and degraded by those who benefit, in the short term, from an unfair, brutal and unsustainable system of values and beliefs. This is not to say native peoples have given up and recently they have had several large triumphs over unsustainable practices of the dominate culture. I believe that indigenous peoples will continue to play a larger and larger role in the cultural discourse surrounding sustainable worldviews and life-patterns based on these worldviews. We who grew up with no viable alternative to capitalist valuations of the diversity and complexity of life are missing something essential. We need purpose, we need happiness, we need inspiration, we need excitement, we need to embrace the wisdom of complex nature. The boy only told the emperor he had no clothes did so because he was too young to feel the pressure to conform to societal norms and values. Why did no one else, including the educated elites and elders, say anything about the obvious truth that was staring them naked in the face? Remember most of the most damaging acts being done to the complex living systems of the Earth are done be very well educated people and so we have to ask the question Orr asks, "What is education for?" (Orr 1991) Who determines what gets included and what is excluded and how that which is included gets taught?

What are the motivations of those privilege with outsized power to make and enforce these crucial decisions? What are their beliefs and world views and where did these biases come from?

For at least the last twenty plus millennia (and maybe as high as 40 plus) the complex natural systems of what is now called the western hemisphere interacted with the human species. During a number of times lasting numerous millennia, when the climatic conditions were right, these humans, especially those oceanic side of the volcanic crest of Cascadia interacted with, or maybe more accurately within, ancient forests. The ancient forests shaped the beliefs and values and knowledge of these diverse peoples and in turn these people shaped, these forests, to greater and lesser extents depending on place and particular culture. So to use a Western term, this represented the beginning of the time when human philosophy and natural history melded and when these values were brought to the complex forests they changed and in a co-evolutionary dance changed the people who changed them and so on… I would love to expand on the diversity and complexity of Native American philosophies, but that is far beyond the scope of this paper and my experience.

The Human Condition

Throughout a giant swath of discourse spanning many fields of thought there is the pondering of the human condition. That is, what is it to be human, what makes us human? I feel that the human condition is one of trying to shape living landscapes to our benefit and yet also having to try to control our worst attributes to prevent us from undermining and overwhelming the natural complexity on which our species depends. For my opening quote of project, I chose the words of Ted Aoki as he first asks and then answers the riddle of the human condition. I think this quote so succinctly encapsulates the complicated struggle to understand the place of humanity in the world that I think its needs repeating as we all need to constantly ask ourselves this

question and give our best answer. Aoki asks, "What is the essential quality of human beingingness?" Aoki answers, "I would argue it is *always looking to balance our desires and our knowledge of the need for restraint and to seek a balance in our sharing and selfish selves, our simple and greedy selves".* (Emphasis is mine) *And, telling stories about this seeking to try to understand them and blend them with the stories of others for greater understanding and reinforcement of sustainable ways of being in the world* (Aoki 2005 p. 8). *(Emphasis mine)* I think this relatively short passage from Aoki gives clarity and purpose to the work of healing that all environmental educators are called to. This is a focus of this project and of my life's work as a student and teacher of the living world. I believe we cannot know if we are finding a balance unless we know what damage and health look like in the living world and as I have stated complexity and diversity are the two interwoven measures that are the best at telling us how we are doing on the eternal human quest for balancing our better and worse halves. I believe our stories of experiences, recognition, and discovery give us the clues to seeking that balance more efficiently.

David Orr has wonderful take on the human condition too. When referring to the myth that with enough knowledge and technology we can manage the planet Earth, Orr refutes this myth stating, "What might be managed is *us*: human desire, economies, politics, and communities. (Emphasis in original) He goes on to point out one of the large challenges to humanity managing itself saying, "But our attention is caught by those things that avoid the hard choices implied by politics, morality, ethics, and common sense." Orr goes to propose a shift of world view solution pointing out that, "It makes far better sense to reshape ourselves to fit a finite planet then to attempt to reshape the planet to fit our infinite wants" (Orr 1991 p. 3). To give some perspective, Orr made this statement 26 years ago, and the situation, especially with regards to making the hard choices, has not changed in any significant way or at least not in a sufficient way. Breaking the myth of "having it both ways", that is a rich, diverse natural world and a lifestyle of excessive material consumption is very hard, but it must be done, or it will be done for us, and that will not be at all pleasant.

This challenge of not ecologically overreaching is not just one of "modern" humanity or even of agricultural humans. One of the best examples of this would be the mega-fauna extinctions. In simple terms these were events at different times on different landmasses when most species of larger animals, mega-fauna, went extinct or were driven to extinction by the arrival of humans.[30] This shows that even humans with what would be called in the industrial world, "primitive" have very large impacts on the ecological complexity of large sections of the Earth. In part these extinctions are attributed to the fact that the faunas of these land masses and humans had not co-evolved over long periods of time. Meaning animals did not know of the potential danger of humans as very proficient, and unique, hunters and that humans did not know just how much impact they could have upon the megafauna. The fact that there was little loss of mega fauna on the continent of Africa, where the vast majority of human evolution has occurred, seems to point to the importance of time with regards to sustainable actions in humanity

The domestication of a relatively small number of plant and animal species of by humanity, agriculture, happened in at seven, possibly eight[31] non-contiguous regions at times that varied by thousands of years and so it could be posited that with humanities curios and experimental mind interacting with so many species of plants and animals for so long in so many ways the advent of agriculture had a certain inevitability. Michael Pollan would say that would say that plants, animals and humans domesticated each other in more multi-directional, co-evolutionary process (Pollan 2001). Since, as Jared Diamond points out in *Germs, Guns, and Steel*, such a small number of plant and animal species have attributes that make it possible for them to be domesticated agriculture is always a process of simplifying nature systems (Diamond 1999). How much a system is simplified can vary greatly with cultures, and even individuals, but it in almost every case a process of simplifying the ecology of at least part of an ecosystem. In a very simplified telling of the story, since its

[30] In line with complexity principles, I do believe that there were probably a number of factors other than human hunting that, such as changing climates and vegetation mosaics, introduced diseases, other introduced organisms and so on… did play some role in at least some of the megafauna extinctions, but I do believe human hunting was the primary factor.

[31] China, the New Guinea highlands, Mesoamerica, the central Andes, the Fertile Crescent, eastern North America before the arrival of the Mesoamerican agricultural suite, Southeast Asia (evidence now suggests agriculture developed there separate from China, and possibly sub-Saharan Africa.

breadth is far beyond the scope of this project, once agricultural passed the relatively small scale, low input, cyclically migratory “phase”, in some places in the world, and became sedentary, high input, high energy, high infrastructure, large spatial scale, surplus producing mono-cultures it profoundly changed many human cultures and made possible the rise of cities and civilizations and value sets like feudalism, and great expansions of slavery and in time made possible the creation and rise to global dominance of the capitalist system**.** This is the system I have grown up in and the one whose values I have tried to reconcile with what I know about life on Earth for most of my life.

The Philosophy of Language, The Philosophy in Language

I think it is valuable to, in the constructivist tradition, examine the language used in Western education and look to both the etymological roots of these words and how they are predominately used now. In trying to reconcile these meanings I think educators can find many potential ways towards education that is complexity oriented. Since this project is so about learning I feel should look at the meaning for the word “learn”. According to Davis, Sumara and Luce-Kapler, “The word learn appears to have evolved from the primitive Germanic word, liznojan, ‘finding or following a track’ and the Old English word, ‘laest, sole of the foot’ The word is rooted in imagery of path-following or path making” (Davis, Sumara, and Luce-Kappler 2008). To give more complexity and diversity to this exploration of learning as a path, let’s turn to another cultural tradition, that of China. In her work, “Speaking the Unspeakable”, Shantena Augusto Sabbadini narrates the legend of the origin of the Tao Te Ching and doing this she examines learning and the limitations of language in learning. In one important passage Shatena relates Lao Tzu’s words to a poor solider-student as

"The Tao that can be spoken is not the eternal Tao". I feel this is a nice statement about the often problematic attempts to describe and define learning, knowing, and wisdom with words. Shantena continues, "The Chinese word *tao's* primary meaning is way or path and metaphorically 'way to be followed, guiding principle, norm, method.' Then by extension also 'say, speak, express, teach.' It should be noted that Lao Tzu is following a "real"/material path *and* the metaphor of the path is already strongly culturally established. Shantena then says, "The sentence is interesting and worthy of being studied in greater detail." With this statement the author is calling for a deeper exploration of meaning, of interpretation. This is to me a call to interpretation of the complexities of meaning. Shantena continues,

> On an initial level we can read it as: 'Any doctrine that can be taught or communicated is not constant doctrine', or 'eternal doctrine', or 'any guiding principle or norm that can be put into words is not a constant norm,' or 'eternal norm'. This statement implies a radical critique of language, not far from that which characterizes postmodern thought: any statement that claims to be true, any doctrine that claims to have normative value is merely relative and changeable. It depends on the viewpoint and interests of the speaker. More generally, all theories about reality are relative. They are merely maps; and as the mathematician Korzybski reminded us, 'the map is not the territory'. Reality, the territory, is forever beyond our representations. But although the Taoists and postmodern thinkers share the same skepticism with respect to language (and rationality), the conclusions they draw from it are markedly different. If language is unable to contain reality, postmodern philosophers choose to forgo 'reality' and to concentrate on the universe of discourse-of shared maps of social worlds." The Taoists make the opposite choice. If language is unable to contain reality, they forgo language and focus entirely on what is beyond language-on the unspeakable. The Tao of human beings may be inconstant and relative, but the Tao of Nature, the Tao of the world, the Tao of being (and of non-being, of emptiness, which the Taoists see as the origin of all things) simply is (Shantena Augusto Sabbadini 2013).

I would argue, given the current dominant cultural situation in the industrial/capitalist world, what is being done by humanity to the global environment is unprecedented. Unprecedented in the evolutionary history of humanity and in the entire natural history of Earth, in terms of scales of time, scales of space impacted and the scales of intensity of the damage done to the complexity and resilience of the living system, or systems, of Earth. This situation is so off the human path that to try to use language, to try to explain with words, is a recipe for always following far short of our goals and intentions. If we are not highly ecologically/environmentally literate, which overwhelmingly we are not in the industrialized world (Gallup 2016; Coyle 2005), then we may not be aware we are falling short. Without deep and broad natural history/ecological knowledge, even if we are aware we are falling short of goals and intentions, we will seriously underestimate how far we are falling short of natural truths. To me this is crucial it is not whether or not we are falling short, we are, it the degree to which we are falling short. I would say this works in several other crucial arguments in environmental philosophy, for instance, the fact that yes humanity has caused great damage to the global environment, but that does not mean we should give up because this is not a simple case of either it is healthy or completely destroyed. Yes, humans have done great damage, but the difference between lighter outcome scenarios that we came to because we made great efforts and the worst case scenarios at the other end of the spectrum of potential outcomes is beyond describable. I would argue that this is akin to Sabbadini's "Speaking the Unspeakable", in that these situations have been rendered unspeakable, that is not able to be conveyed by words. Does this mean we should not try to speak this truth? No. Even though the Tao cannot be spoken Lao Tzu tries to impart the wisdom of the path to the poor solider. In the telling of the Tao, attention is focused and the endlessly complex nature of the Tao, life, can be acknowledged in the stating of the fact that it cannot be explained. For me this means that I will continue to teach, but only in the places where complexity is most open to being experienced in all ways possible by as many unique people as possible. Only in this way do we hope to continue the age-old human conversation about the nature of life and humanity's role in the life of the world.

When I am in the ancient forests so many words come into my mind. I was raised with language and my brain is conditioned to interpret experiences into language. I then use this language to share my experiences with complex nature with others. When I am doing this I often cannot stop my mouth from uttering an endless stream of all these words my mind is using to try to interpret and convey what I am experiencing. There is always something profound, emotional, spiritual, that cannot be spoken, cannot even be grasped in words, it is as best as can express it, a feeling of rightness of health, of home. I know part of this is deep evolution in a world where complexity begets complexity. It seems that in the power of emotion, of spiritual connection, of what has been called the magic of life, we are connected enough to maybe allow us to override the powerful pressure of our culture to value the life of the world purely as commodities for our pleasure and experiences that are to be quickly consumed. Maybe trying to access this connection is the way we can give a little advantage to our better selves. This does not mean that knowledge, categorization, and naming should be abandoned, quite the contrary, they too are an essential part of the human way of connection to the world. When I see new plants, or new forms of plants I know, I am excited, I am flooded with positive emotion, learning is for humanity an emotional process and we as educators need to try to facilitate learning where the emotions attached are what they have been throughout the vast majority of human evolution: positive and reaffirming, sometimes scary, always key to human survival.

Great tomes of history, sprawling philosophical works, expansive religious scripture, poetry, art, dance, acting, debate, music and so many other forms of human expression have been created in so many languages, in so many mediums, in so many lands by so many groups and individuals over so much time, all inspired by the mystery of life. All together this work dedicated to finding the place, the role, of mankind in the intricate and complex beauty of life amounts to a mass of cultural material that is hard to fathom in its immensity and in it importance and relevance to humanity.

For this I teach in the woods. I would argue that the best of these cultural expressions of life, these attempts to give words to that which cannot be spoken, these myriad interpretations of the complexity of life, were

based on intimate experience with diverse nature. To feel the presence of the unknowable, to be enlightened and invigorated, inspirited as Aoki says (Aoki 1995), one must be in the places where the magic of complexity still exists, where deep time and endless interactions are on display in shapes and forms that delight and mystify.

In these two quite different traditions learning is seen as a path and it becomes evident that the metaphorical reading of the path has been with us for a long time. I would note though that although a metaphorical path and a metaphorical journey dominate the discourse in the industrial world, these concepts had their origins long before writing and before spoken language. Learning for humanity involved following and creating physical paths and tracks and in this process individual humans and humanity gained great knowledge and insight about the world and through this they tried to find their place, they tried to find a way manage themselves so that they did not override the sustaining complexity of life. To this day this search continues and as educators we have to play our part, heed our calling to understand.

Not to sound too much like a philosopher, but I have always seen the seeking of knowledge about ancient forests as the search for "truth". In a revelation for me that is very close to my life's passion, Andreas Kornevall writes in *Trees in Schools,* "That truth and tree derive from the same root"[32] (Andreas Kornevall 2013, p. 27). I find it illustrative that we use the tree derived word "root" to talk about the etymology of the word "tree". Remember here too, that although we use the word and image of a tree for so many metaphorical uses and trees are everywhere in human languages that these are real trees too and that our minds are set to the fractal light patterns of shade under a massive ancient tree canopy and always using trees to look far and as an escape from so many grounded dangers and that running very far back in our evolutionary lineage and lasting for a the overwhelming span of time in that lineage we were purely to nearly purely arboreal, trees were our world and certainly everyday life. In fact, fossil discoveries, in China

[32] In Old English "truth" is triewth or treowth, meaning faithfulness or *constancy.* (Emphasis mine) The word seems derived from the Old English word for tree, treow, which came to Old English from a Germanic variant of an Indo-European root shared by Greek, "doru" meaning "wood, spear"; "drus" being "oak".

coincidentally, have pushed our time in the trees back another 50 million years over what was formerly known to at least 125 million years! This was the time that the eutherians, which make up 90 % of today's mammals, mostly placental, from rodents to humans[33], were starting to differentiate from the marsupial mammals. Humans came into a world of forests and even though we have largely left the branches we are still deeply evolutionarily attached to trees, especially very large trees.

I think another key element in the truth of trees in human evolution can be found in Jared Diamond's brilliant work, *Collapse: How Societies Choose to Fail or Succeed*. Diamond points out that, "Deforestation was a or the major factor in of all the collapses described in this book." and conversely those societies that succeeded in finding a balance to the human condition did so be addressing their environmental overreaches in the ways the interacted with the forests of their home regions (Diamond 2006 p. 487). In looking at arguably the most extreme case of societal collapse, Easter Island, Diamond answers the great question of this narrative. The question being, if the natives of Easter Island knew they were cutting the last tree on the island, and given the size of the island they pretty much had to know, then what was the person doing it thinking as they were doing it? Diamond points out that the loss of forests might have taken place over a long enough period of time that it was not that noticeable. Diamond makes the argument that by the time the last tree was being cut trees had already been rare for a while, forests for a long time in human terms (Diamond 2006 p. 114). I would add that by this time primary forests, which included the world's largest palm species[34], were probably only fount in the telling of long oral histories. One thing that I would add to Diamonds argument is that the first great loss of complexity and resilience in the process of deforestation is the loss of the ancient forests, which happens very early on in the historical arc of deforestation.

I think there are some interesting contrasts between the Easter Island story and that of the experience PNW. In the PNW the rates of loss of ancient forest has been fast enough for most of the loss of ancient forests to

[33] Notice the hierarchical ordering with humans on top.
[34] The native palm, now extinct, Easter Island was closely related to the Chilean wine-palm, but this palm was larger, exceeding seven feet in trunk diameter to more typical 3-4 feet trunk diameter for its mainland relative.

have occurred within one human lifetime and so we should be very aware and alarmed. On the other hand, the loss has been so great and so quick that most in current generations have never experienced a PNW where ancient forests were very widespread across the landscape, including close to the places where most of the human populations live.

An Alder Story: Noticing the Unnoticed

As I have previously pointed out, Davis, Sumara and Luce-Kapler say that one focus of education should be to help people realize what they do not notice (Davis, Sumara and Luce-Kappler 2000, 2008). So what realities of nature are missed under a capitalistic-reductionist worldview? In the book, *Forests of Time: A Century of Science at the Wind River Experimental Forest,* Margaret Herring and Sarah Greene relate a story about a profound change in perceptions of the red alder tree (Herring and Greene 2007). The story, and the authors' analysis, is very illustrative and illuminating on the point of what is missed when cultural values focus on a narrow section of the complexities of PNW forests. I think there are also contained in this story some ideas as to how an educator could help leaners correct these particular deficiencies of understanding and help them notice many other potentially "hidden" aspects of PNW forests.

For many decades, forest managers, especially forest managers for industrial scale timber companies, considered red alder a pest species, an impediment to the productive work of scientifically designing ideal forests that would produce the largest amounts of the most desirable wood in the shortest periods of time for the greatest profits. Loggers and forests managers had noticed that in places cleared by logging and/or fires, alder seedlings competed vigorously with Douglas-firs; the "money tree". So red alder was certainly noticed by foresters, but not in an appreciative way. Attempts to spray alders with herbicides did not stop them and scraping and otherwise scarifying the land only seemed to encourage alder growth versus other

more economically desirable species. How alder could survive and even thrive under this assault was a frustrating mystery. Most scientific foresters saw alders as an enemy to be conquered.

Herring and Greene explore the role of experimental forests, in particular at Wind River Experimental Forest in South Central Washington, in speeding up the process, and under capitalism speeding things up is key, of converting brush and alder, and of course ancient forest, into young "forests" that were heavily managed for maximum timber output. The story that the authors relate is from a personal narrative of Robert Tarrant, a soils scientist who worked at Wind River for some time.

> "When recounting his experiences at Wind River many years later, Tarrant expressed that he had, 'a *special affinity*', for Wind River. 'It was the sight of so much of the first work, the original studies that defined the region, a *place of important discovery',* he recalled." (Emphasis Mine) [I can definitely share many of Tarrant's feelings, for similar reasons, about my experiences at Opal Creek.] Tarrant made one of those important discoveries near Planting Creek in 1948. Herring and Greene relate the story, "While making a soil reconnaissance on hilly slope on a hot day 'through nondescript, yellow-foliaged Douglas fir plantation.' He unexpectedly came upon a shady forest of red alder mixed with Douglas fir. 'Perhaps because the day was hot and the mixed forest was unusually cool, I stayed longer than I might have otherwise', Tarrant remembered. He spent several hours wandering through the alder and Douglas fir, where it was several degrees cooler than the surrounding plantation. He noticed that the foliage of the Douglas fir planted among the alder was exceptionally dark green, the needles were more abundant and larger, and the surface of the forest floor was thick with leafy duff." (Herring and Greene 2007, p. 93-94)

With further inquiry, Tarrant found out that these alders had been planted, which was unusual at a time when there were concerted efforts to eliminate alder. It turns out that Leo Isaac, a senior scientist at Wind River, had wanted to test the validity of some comments from experienced tree planters with whom he had

spoken (Herring and Greene 2007). The tree planters indicated that alders stands were quite fire proof and that a running fire would stop at an alder stand. (I find a personal connection to this part of the story since, as I indicated in my opening narrative, my father was a tree planter and this experience helped him learn a great deal about the natural processes in the forests of Cascadia.) Given that fire was considered to be a destructive scourge of commercial forestry, Isaac had planted the alders to test these trees for their ability to suppress fire[35] [36], but is would be other lessons that would come from this experiment.

This story of the discovery of a mutualistic relationship between alders and bacteria in the genus Frankia, which essentially allows alders to fertilize the soil with nitrogen in a form usable by plants is one layer of discovery, one strand, that can be pulled from this interesting narrative. I think that with some prompting and support from someone with more experience with forests ecology training an environmental educator can glean more from interpreting this passage. It is interesting though that when a *culturally important* discovery comes from an experience the other "extraneous" details drop into the background and all focus is on the payoff this information can provide. This story is useful in that it reinforces the role of surprise in learning. It also shows the role of time, focus, concentration, and passion in understanding the riddles of natural complexity. The conclusion of this story illustrates how dominate cultural values can influence the use of knowledge gained by such discoveries.

I think this story, along with so many others, reinforces the tautological status to the assumption that any relatively ecologically intact nature system is far more complex, layered, deep, and multifaceted than a relatively narrow focus can possibly reveal. In delving deeper into the rich insights of this passage, I would first point out that the author says that Tarrant had a "*special affinity* for Wind River" and that he said of

[35] It is true that alder and many other deciduous angiosperm trees do tend to moderate fire behavior because they do not combust and "carry" fire as well as the resinous conifers. This is yet another factor how fire can shape forest complexity and another reason, of a huge number of reasons, that diverse forests composed of many species of trees, of many growth forms, are far more resilient than mono-culture plantations.

[36] It should be noted that ancient forests that are allowed to burn within their natural fire regimes also moderate fire behavior, usually creating conditions that lead to low to moderate intensity ground-fires, which do little harm to most of the "well-armored" ancient trees, but do greatly enhance ecological complexity and diversity through fire behavior that is so complex that it may seem chaotic to human perceptions.

Wind River, "It was the sight of so much of the *first* work, the *original* studies that *defined the region*, a *place* of important *discovery."* (Emphasis Mine) He has a long and somewhat emotional, as evidenced by his somewhat nostalgic recounting, connection with this place. When Tarrant talks about defining the region he is making the landscape legible, and "real", within the values of his worldview. By creating that place with legible boundaries, like I did at Opal Creek, he can be attached to that place and that place can be attached to him. Tarrant talks first about the yellow foliage of the Douglas fir plantation. He then comes unexpectedly on the shady mixed alder and Douglas-fir stand. The shady greenness seems out of place with his experience to this point and yet it is welcome. Finding this stand is a surprise and I would guess that that is part of the reason he explored this area in more depth, he is obviously intrigued and this leads to exploration, to inquiry. This story does point to the element of chance in discovery and to the fact that chances for discoveries are enhanced by frequent long visits made to natural places in many conditions. It is by chance, as far as we know, that it is a particularly hot day when Tarrant visits this area. The fact that the mixed stand is so much shadier[37] and cooler is another reason he stayed longer than he otherwise might, and this additional time and interest, the excitement of a surprise and the cool pleasing conditions increased the chances of an important discovery being made. That is, one could say that the conditions in the mixed stand made him feel more comfortable and therefore his physical-emotional state encouraged him to stay longer and explore. (To ground this in field based environmental education, facilitators should always notice environmental conditions, like weather, and the comfort levels of learning community members to enhance learning opportunities.) Tarrant paints a vivid picture of the health of the Douglas-fir in this stand by noting the size, abundance and color of the foliage; not just one characteristic. He says the foliage is "exceptionally" dark green. This intensifier points again to surprise and to heightened curiosity because obviously there is something powerful going on here. Chance and time again intervene in the fact that Isaac's alder seed was late in arriving and so the Douglas-firs got a head start in growth that meant they effectively hid the inter-

[37] Thermal cover of forests which moderates temperatures and is beneficial to organisms in cold and hot conditions

planted alders thereby increasing the chances they would not be removed. The fact that Isaac still remembered the story of the alders provided a living oral link that Tarrant could follow to get the history of this stand. Tarrant goes on to note that in the mixed stand, "…the forests floor was thick with leafy duff." This points to the immense complexity and importance of forests soil systems and this discovery would help start more of that great exploration of immense complexity and foundational forest ecology. This last part of the story hints the mutualistic underpinnings of life on Earth that went unnoticed, and usually still do, in dominate American culture. In a culture raised on the mantra of "survival of the fittest" I am sure it would surprise many to learn that mutually beneficial relationships between a huge range of widely diverse organisms actually underpin most of the life on Earth. Forests and especially ancient forests are made possible by the mutualistic relationships between whole different kingdoms of life: plants, fungi, cyanobacteria, algae, bacteria, animals and a diversity of additional microbial lifeforms. It is up to natural complexity educators to illuminate these truths of life.

Now from my own experiential biases regarding forest natural history, my first inclination is that Tarrant's discovery of the special nature of red alder will lead to inter-planting alder into commercial stands, which would make this element of forest management a better mirror of natural processes. I then catch myself and remind myself that this experience took place in 1948 and I don't recall any mention of this paradigm shift in forestry until a good number of decades later. This was still the era when it was believed that science could solve any problem, improve anything, even, and maybe especially, nature. There is a parallel here with my assumption that the Nooksack RNA was set aside as a complexity, diversity and structure baseline for ancient forest when in fact it was set aside to give a baseline for forest productivity in natural stands so that scientifically designed forests could be compared against them to gauge progress in making the most "efficient" forest possible. It is very telling, with regards to cultural sustainability, that once it was discovered that the *Frankia spp.* bacteria housed in root nodules on red alders improved soil productivity by infusing

large amounts of nitrogen[38] into the soil, forest managers took a quick leap from this new understanding of natural fertilizers to start applying chemical fertilizers to commercial stands. This move, the authors point out, "reflected an assumption that characterized the years following World War Two: technology could improve whatever nature provided" (Herring and Greene 2007, p. 94).

So another crucial element in human forest relations that this story revels is the potential for hubris in humans. The great successes of Western Science, particularly in World War Two, lead to overly abundant and unbalanced levels of optimism in human ingenuity and the ability of humanity to control and even improve on nature. The resulting inflated egos and skewed worldviews can be directly traced to the largest environmental problems the human species now faces. These ideas, these mindsets, are hard to shake even given that so much more is known about just how complex life is and how poor humans can be at balancing their wants and the healthy complexity of the more-than-human world. It does lead to thoughts about what the forest health situation in Cascadia would look like now if foresters had started planting alder right after the discovery of its special ecological role was made. This was one of many opportunities to learn from complex nature that were lost in the din of cultural dictates about the right ways manage and use forests. There was not a realization that that tens of millions of years of evolution of these species together had created a relationship that was very biologically productive *and* very resilient, and therefore potentially sustainable. Researchers noticed the increased productivity aspect, but they missed the power of mutualistic relationships in creating a bounty of life. I would also be remiss if I did not to point out that capitalism always pushes hard for a maximization of profits and therefore control and simplification of complex systems to allow for more stable investments with larger and more predictable profits on investments. Reductionist, mechanistic views of the forests reigned and maximizing timber output and timber profits topped all other concerns.

[38] Nitrogen is the usually the most important nutrient limiting plant growth in the PNW, that is the amount that is available sets the upper rates for plant growth more so than any other essential nutrient

By contrast to the Euro-American views of alders, many Native American groups of Cascadia found alder to be a very valuable tree with many uses. Erna Gunther and Daniel Matthews in their respective works point out that many Native American groups in Cascadia used alder for: a red dye, a medicinal and invigorating tonic, high heat value fire wood that very importantly does not throw sparks, clean burning coals for smoking salmon and mussels and berries and so on…, for making utensils and masks, to dye nets so they were invisible to fish. In addition, alder groves were favorite places to hunt for animals drawn to the rich plant cover on the floor of these beautiful groves (Mathews 1999; Gunther 1973).

A personal formative experience that I had with the idea of "noticing what is not noticed" happened when I was an educator for a Thanksgiving "family getaway" at the North Cascades Institute. I decided to offer an ancient forest ecology hike that would head up the first few miles of the Thunder Creek. I was very happy that there was quite a bit of interest. Each one of the participants told me that they had experience with ancient forests. We headed up the creek and there was a fair amount of snow and this gave a whole new appearance to a forest I had been in many times before. A way into to our hike we came to a place where a stream-side stand of western red-cedar had been killed by a large smothering blanket of sediment from a debris flow that had come down Thunder Creek's canyon. The cedars were now a collection of beautiful snags and several had fallen into a channel of the creek that flowed directly beside the path. I pointed to the wood in the stream and exclaimed how ecologically important wood is in streams, rivers, wetlands, lakes, estuaries and even oceans and that one of the key ecological benefits of ancient forests is the way the slow, direct and purify water. The people I was leading were surprised by what I had said and I was in turn surprised by when they said they had not been aware of the very important role wood in water played in the ecology of ancient forests. So they had failed to notice the wood in the streams in the most literal sense, in that I had to point it out to them and they had not noticed the impact this wood was having on the system. In fact, it may be at least in part because they did not know the important role of wood in water in ancient forests that they did not notice it. If we think something is important we are of course much more likely to notice it and since wood in water is a key component of ecological complexity, and one that is often

overlooked and also often missing from current systems, this is something I want people to know about, I want them to notice.

The Unexpected Orchard

Even short lived experiences, given a background of experience to draw on, can be transformative events. In the section, “Seeing for the First Time”, I tell the story of a transformative experience that did not last a whole day and yet it had a profound impact on me as an educator and as a person, and I hope it had lasting impact on the young adults with whom I shared that experience. More recently on an outing in incredible ancient forest with a professor of mine, we shared a transformative educational moment. It might not have been as profound as my AmeriCorps experience, but it brought about valuable insight. We had both visited ancient forests before, but maybe this level of familiarity helps prove a bigger truth, that complexity keeps giving, keep luring, keeps promising more excitement of discovery of making connections. We traveled to one of the last remaining large chunks of low elevation ancient forest in the PNW. This is important because although it would be inaccurate to say, “it’s not just any ancient forest’’ since there is no typical ancient forest, nonetheless this area is something very rare now in the PNW. Due to fact that optimal conditions for humans and many tree species overlap so much the most productive ancient forests, the ones that showed the maximum potentials of these forests and these tree species, were the first cut, the most severely cut and the most likely to now be in private ownership or even no longer forested. The place we visited was not one of those at the very top of the productivity continuum, but it is about as close as we can get in 2016. In this place we got a hint of what otherwise we might find only in a relatively tiny number of historic photographs of the ancient forests of the PNW.

I don't think I realized the significance of a particular event on this trip at the time it happened because there were so many experiences flowing in, as has been the case each time I have visited an ancient forest. This experience was a "real world" validation of the approach to education that both my professor and I advocate for and this was a satisfying feeling. I think recounting this experience would be an effective way to demonstrate some elements of a natural complexity based educational approach. I think one take away is that even small moments can lead to big insights and so it is important to be aware and receptive at all times, because real experiential lessons are not scripted and they do not follow a schedule and they can come from any direction and at any scale.

Davis, Sumara and Luce-Kappler propose that **"**difference" and "surprise" drive conscious awareness, which drives learning and is difficult to attain and is fleeting, and that accordingly human perception/neural systems are oriented towards surprise and differences in our environment (Davis, Sumara, Luce-Kappler 2000, 2008, p. 26). When we came upon the moss covered stand of native apple trees and my professor figured out their species identity, I would say a genuine moment of surprise occurred. At that moment I also made a memory based comparison and realized that my initial experience with these trees elicited a very similar response. This experience was nested in a day filled with surprises and excitement as a result of experiencing these spectacular, beautiful and rare ancient forests in which this little "orchard" was nested. A phenomenon that I experienced that day, and have experienced so many times with ancient forests, is that even though I knew these forests were grand and beautiful, I could not in my mind hold on to just how grand, beautiful, diverse and complex these forests were until I was in them again. I think these speaks some to the limitations of human senses and the human mind and its memory abilities. I have a good memory, which I partially attribute to my time in ancient forests, and yet I cannot never fully capture in my mind what I experienced in these forests even if I have visited a forest multiple times, even when I have photographs of these places, some with me in them. I can only conjure up a little and yet even this little is rich enough that it makes me happy to think back and makes me want to return.

My professor asked me what kept me coming back to these forests and I said that there was always something new, that I could never know everything, and that my perceptions of these forests change each time I come to them since I have changed each time I come back. To that, it is the promise of surprise, mental stimulation, physical stimulation, of personal discoveries that move the evolution of my understanding of the complexity of life and the importance of that has kept me coming back to ancient forests decade after decade. The new, the novel, the shades and shapes, the sizes and heights the ages and the very gradual awareness of one little bit more of the continuum of complexity interpreted through scales of time, space, and, and, and…, to borrow from Aoki (Aoki 2005), this is what keeps me coming back and makes me want to share these experiences with others, especially in the forests, but also when I am closer to home.

I as I have already said, the first time I saw these trees I too was very surprised and much flowed from that surprise at that moment and well beyond. Even though I have since seen these trees a number of times I am still a little surprised each time, and I was again on the day my professor and I saw them. Maybe part of it was sharing in my professor's surprise, which made it somehow more exciting and rewarding and fun. Davis et al talk about mirror neurons and how we play out in our heads the experiences we witness others having as a way that we connect with each other beyond our individual persons (Davis, Sumara, Luce-Kapler 2008). I think maybe there was greater excitement because we could share how this experience challenged our expectations for this plant species and why that might be.

Later my professor pointed out a patch of sphagnum moss that was, in a very unusual way, growing on a slope above a trail-cut, not a wet microclimate as would be the norm for this plant in all but the wettest places. Both of these experiential events point again to assertion that Davis, Sumara and Luce-Kappler make about teaching being not as much about teaching students what they don't know, but really in *helping students "notice what they have not noticed"* (Davis, Sumara, and Luce Kappler, p. 26). I also saw connections to the authors' ideas of sparking conscious awareness when I think of all the possibilities, associations,

connections, memories, comparisons, ides, theories, questions, and a strong desire for answers and understanding, that flooded my mind the first time I saw these trees and started to know them (Davis, Sumara, Luce-Kappler 2000, 2008). In listening to the things my professor said when he guessed the identity of these trees, I assume he was having a similar experience. I have really tried to hone my skills because I believe strongly that careful listening is very important in the process of learning-teaching and I have through my experiences noticed that this element of communication, the root of teaching, is often undervalued and not well practiced.

Based on our experiences with the type of forest we were hiking in and our experiences with the species *Malus fusca*, or some might say *Pyrus fusca,* (that is a wild apple or a wild pear respectively)*,* this stand was unexpected. What's more, these trees challenged and changed our expectations with regards to the size this species could attain and in growth forms it can take on. I would say this experience challenged our understandings of the potentials of time, space (volume) and complexity for native crabapples This challenging of expectations can and should be applied to many species by educators of a natural complexity focus. The experience was surprising and I would say satisfyingly surprising, surprising in a fun, thought provoking, and mind expanding way.

The fact that this scene was surprising I think also holds great room for exploration as to why we did not expect these trees to be at that place, in that kind of forest, with those particular growth forms. The fact is that this experience would be surprising for the vast majority of humans today, that is if they could recognize the species and knew enough about it, including the human history of interactions with it, to realize why this stand was so important. Importantly, this means that ecological literacy skill of plant identification and knowledge of the natural histories of plants has to be there of the surprise, the excitement, the connections and ideas and the memories won't happen. Even for those who regularly visit the forest and even for those who come to the forest to research, teach, and botanize, this kind of stand would be far from common. Why can I make such broad statements about this situation? (I might ask the learning community this question.)

The fact is that this kind of ecological/natural historical setting would have been far more common within "historic time", a term defined and applied by the dominant colonizing culture, and throughout the much longer time period of human habitation of the PNW and interaction with the native crabapple. I know this by extrapolating what I know about the ecosystem/microclimate the trees are growing in and then expanding out the possibilities of similar conditions in similar ecological settings prior to the massive landscape changes wrought be the implementation of dominant Euro-American cultural values on complex nature.

This experience and all that flows from a stimulated mind points to the fact that our ability to experience the full complexity of this species and so many others and the complex systems they make up has be greatly diminished as these systems have been greatly degraded. We must have as accurate an understanding of what has been lost as possible if we are to move to restore what we can.

It is interesting to think that only at the very beginning of the colonizing process in Cascadia did Euro-Americans even get a chance to witness the complexity of the region at very high levels. They had a brief chance to experience the incredible ecological complexity of a landscape that was at least in part the outgrowth of the eco-cultural co-evolutionary dance between humans and the other organisms of the living systems of the region that had already been unfolding and evolving for many millennia. Euro-Americans had a chance to experience these things foreign to them, but it seems that in the vast majority of cases their enculturated biases prevented them from really understanding or valuing that which was different and considered inferior: peoples and landscapes. Euro-Americans would divide Native Peoples from the landscape or lump them together as wilderness and wildness when it suited goals depending on what they wanted to do to the Native peoples and to the land. The fact is that complex ecological systems at low elevations in the foothills of Cascades in areas of high precipitation were at one time very wide-spread and to be even more precise areas like this that had areas that were directly influenced by lakes or large wetlands or meandering river complexes were quite common. Other low elevation, very productive sites in the "Puget"

trough, the watershed of the Salish Sea, were common and there these trees could grow to sizes and in complex forms that we just don't experience very often at all today.

My mind was transported in time back to pioneer experiences with these forests and then to the vast stretch of time that a great diversity of Native American cultures actively interacted with this species, it was an important food species. My mind also travelled on the time scales and shifting spatial scales of the biogeographical history and the evolutionary history of this species and of the rose family (and of course we could go on to the evolution of flowering plants, conifers, trees, land plants, plants, life, earth, our sun, our galaxy, the universe and … To have this ability to "level jump/scale jump" and to understand how, why, and where to use this skill and how to help and encourage others to hone and use these abilities are all things I think every natural complexity history educator should strive to have.

I definitely can say that this experience and the whole experience of the day left me wanting more surprises. I think this gets to my assertion that what the human sensory system is seeking/fishing for/ as you said, "yearning for", is complexity.

On the drive back from our outing, my professor pointed out that without the ability to identify the trees we saw as native apples, we might not even have noticed them, made note of them. I would and without some knowledge about the ecology the species we might not have grasped the weight of this situation and we would not have remarked on them, which is key to cultural spread of ways of knowing. Without this knowledge we would not have had the surprise and all that flowed from it. It should be pointed out that these levels of recognition should be quite honed for as you saw it is quite hard to identify these trees at certain times of the year and especially if they are lumped in with the other moss and fern covered angiosperm trees, which unlike this species, are expected in this environment. Knowing this tree in the broader sense would also mean knowing about the importance of the fruits for animals and the human animal for many millennia and the great importance to native pollinators of these flower covered trees and the great love of the leaves and twigs as browse for many animals. To look further at the element of surprise

in this outing, both my professor and I were surprised to see this species growing in a conifer dominated ancient forest. We were both used to finding it in wetlands, lakeshores, seashores, flood plains, and riparian forests. So given all the great educational that arose from this simple experience given certain levels of ecological literacy in the human component of this interaction, what are the prospects for this kind of learning in American society?

One of the most profound lessons that I learned through my life experience has been that the general public in my country knows *very* little about the environment that supports them. In fact, the word "very", or any other word for that matter, fails to convey the severity of this dearth of understanding. I make this assertion based on my many years of seeking some picture of environmental literacy levels, and also from some of the relatively scant research on the topic. One of the few relatively extensive works on this topic is *Environmental Literacy in America*, written and compiled by Kevin Coyle. In the creation of this work Coyle amassed and analyzed a mountain of research and polling data covering ten years and came up with some conclusions that should be of great importance to all environmental educators, and really all educators and citizens. (Coyle 2005) This material, like all studies, has it biases and flaws. Some might ask if data collected almost two decades ago is still relevant in a rapidly changing culture. In my assessment many of the conclusions hold true. I feel that part of this lies in the fact that many of the most influential cultural influences on environmental literacy have not really changed all that much, unlike a number of other aspects of American culture. Coyle says that when he and other environmental experts and educators think about public environmental education and information levels, a framework of three levels of learning *emerge:* environmental awareness, personal conduct knowledge and environmental literacy. (Emphasis is mine)

Since my goals include the fostering of deep and broad knowledge and understanding it will come as no surprise that I am most interested in the levels of environmental literacy and what Coyle, and other contributors to this study, believe is needed for someone to reach this level of understanding. Coyle says that, "Environmental literacy is distinct from simple awareness or immediate personal conduct instruction

because of its *depth* of information and the actual skills (*thinking and doing*) that are imparted." (Emphasis is mine) As an educator I am deeply concerned about the depth and breadth of environmental knowledge. Also, I think Coyle's idea of "thinking", and especially, "doing" can be related to Aoki's teaching what we do and doing what we teach (Aoki 2005, p. 20). In a simple sentence that means a great deal to my work, Coyle says, "True environmental literacy takes *time".* (Emphasis is mine). I could not agree more with this statement as it gets to the heart of my educational philosophy. Coyle goes on to assert, "Most real environmental education involved actual *hands-on experience* with a subject either in the lab or the *field*. (Emphasis mine) For me the field has always been the emphasis. I am not saying the good things do not come from work in the lab, I know from personal experience they do. I am saying anything done in such a simplified educational environment must put in context within the whole. I also feel that in the balance definitely more time should be dedicated to direct experiences in complex nature. Finally, Coyle makes a statement that is truly important to driving my life's work, including this project, when he states, "The research shows that very few people have sufficient environmental knowledge and skill to be considered environmentally literate. While there are no 'hard' numbers on the subject, an estimate of 1% to 2% of adults in America seems supportable" (Coyle 2005, p. xiii). Although I too do not know the actual numbers, I do have to echo Coyle's assertion that the numbers are very low. I would expand on this by saying that with technological advances since the time of this study people have access to orders of magnitude more facts/data, but in my experience most of this is made up of disconnected facts, figures, and ideas. This potential body of knowledge if not connected to the whole is trivia and trivial. In addition, without a deep broad understanding of the environment, consumers of this data would not be able to properly assess the biases, credibility, skills, and knowledge of the persons providing the content. A disconnected mass of data misses the histories, stories, connections, shades and subtleties. Finally, if a search engine is doing too much of the searching than the human mind will not form the complex neural web of connections needed to make sense of the complex connections of life.

It is worth noting that this date refers to a random sampling of the entire population of the U.S. There is far less data on the levels of ecological literacy among those who chose to become environmental educators. One could safely assume levels would be higher than the general public, but how much higher? It is encouraging though that these people are making an effort to know more and to connect more and I think it is the goal of the educators of educators to provide an environment where this process can take place as efficiently and joyfully as possible. Coyle mentions Richard Louv's book, *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder* (Louv 2005), and indicates that, like Louv, he worries about nature deficit disorder and he feels that it is prominent factor in levels of environmental literacy in the United States. I have to personally echo Louv and Coyle's concerns on this issue. I am additionally concerned that even when children do experience nature it is now often nature that is so simplified that there is value in these experiences, but also a danger that they might become accustomed to, and accept as normal, level of complexity that cannot sustain high levels of eco-cultural resilience. I worry, like Kathleen Dean Moore does, that young and old people today will forget, or in some cases never even know, what intact[39] natural systems look and feel like (Kerr 2005).

[39] Intact in a relative sense.

Conclusions

This project has been a reflection on my lifetime of experiences growing up in Western Oregon, and in various places within the broader region of Cascadia, interacting with local environments, especially ancient forests. It is my interpretation of these experiences that have informed me as to how my culture has interacted with complex environments. As I indicated in my introductory narrative, I was raised in a family where environmental and political awareness, knowledge, and activism were encouraged, taught, and fostered. Giving this upbringing, I have been a diligent, eager, and devoted observer and participant in the natural history of Cascadia for almost 40 years. Maybe most of all it is the perspective I have gained over these decades that has really driven me to propose the teaching approach that is at the heart of this project. In short, I have seen far too little progress on environmental issues given what knowledge about the health of the environment is now available and all the experiences with the loss of natural complexity that citizens of the world have experienced just in the last 40 years. I should point out that it is absolutely outrageous for a mere 40 years of experience to be yielding so much perspective on the degradation of complex natural systems. To have this much change in so short a time is unprecedented in the entire natural history of the Earth. Well, maybe one exception might be the meteorite impact that created the Chicxulub crater in the Yucatan and was responsible, in large part, for the extinction of the dinosaurs[40], and many, many other species of organisms. The very fact that it is reasonable to compare these two events in terms of severity of environmental impact, I feel speaks volumes about just how very[41] extreme the human driven global environmental crisis is.

[40] With the exception of birds.

[41] Here, and throughout my paper, I have made great use of qualifying and intensifying words. I have done this because I feel that words are inadequate in terms of imparting to readers the true weight of many complex, holistic, and intense situations and so I am doing the best I can to relate the true weight of situations and concepts with the tools I have at my disposal. This is a key reason I advocate for emotion eliciting first hand experiences in

I realize that the blame for the lack of progress with regards to creating more ecological resilient cultures cannot be laid solely at the feet of environmental educators and environmental organizations. I realize that dominate cultural values and power structures have greatly impeded, and even often greatly turned progress back, on moderating our culture's environmental behaviors. For this reason, I have proposed a holistic form of environmental education that acknowledges complexity and holistic thought and therefore examines and critiques culturally dominate economic, political, and social systems and the philosophies and motivations that underlie them. This project has been about the perspectives one can gain about the role of complexity, given time, focus, and passion. I have explored what I have learned through decades of transformative, emotional, exciting, enlightening, knowledge building and wisdom building experiences and in the process of reflecting on and interpreting those experiences and their evolving impacts. So it seems to make perfect sense in this conclusion to ask how the ancient forests, so essential to natural complexity learning, are faring. That is, what is the state of ancient forests in Cascadia in 2016?

It should be evident to anyone who has read even this sampling of my personal experiences with ancient forests contained in this project that what I would like to say is that the ancient forests are doing fine, are recovering from the damage done, that they are finally *protected.* It pains me a great deal to say that unfortunately, as a keen observer and an educator dedicated to speaking my truth, I cannot say that.

One ominous trend is that discussion of the ancient forests has drastically dropped off in the national discourse. During the "Timber Wars" that raged in Cascadia when I was younger, and in particular during the "final" stages of this clash of cultural values, the "Spotted Owl Phase"[42], the ancient forests of Cascadia dominated the regional discourse, were very prominent in the national discourse, and even had a fairly

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the beautiful complex of the ancient forests of Cascadia; so people can experience that which cannot be spoken (or written).

[42] The northern spotted owl is an ancient forest dependent species that is also an indicator species for ecologically high functioning ancient forests. Almost a century and a half of logging in Cascadia, and especially the most intense phase of logging, the last 30-40 years (the timeframe in the mid to late 80's) of industrial logging, had drastically reduced spotted owl numbers to the point that the bird was listed as threatened with extinction under the Endangered Species Act. This listing enflamed passions and lead to cultural/economic battles boiling over with emotion.

significant airing in international discourse. Now dialogue about these forests, even in environmentally focused quarters of the public and the media, has fallen off dramatically. I would think that many might say, "Ancient forests, didn't we resolve that issue, aren't they protected?" Yes, there were the late successional reserves set up in the wake of the spotted owl decision and there were some protections to other remaining roadless areas and even a few more designated wilderness areas were set aside, *but* the ancient forests are more imperiled than ever and this of course also means that humanity is more imperiled than ever in this closed interdependent global ecological system.

One conclusion that I have come to is that natural complexity education is needed more urgently than ever to help save what can be saved of resilience bestowing natural complexity in the world. For instance, the profound impacts these forests have on climate change, soil formation and erosion, biodiversity and water quality and supply. I feel these forests also need to be preserved, as much as is possible, to provide opportunities for learners to interact with these forests where so many lessons about living at sustainable rates and scales are so beautifully and clearly displayed. I also feel that the vast acreages of young forests and plantations, that now dominate much of the landscape of Cascadia, must be managed in ways that enhance complexity as quickly and completely as possible. There is no substitute for time in the creation of ancient forests, but we have learned some things from studying the process of forest succession into ancient forests and then to ever more complex ancient forests and on, and on…, to know some ways to modify the simplified, mono-culture, stands our values systems has created, so that it hopefully takes a little less time for some kind of ancient forest to return across vast spaces of this forested region. Given the impacts of climate change that are already being felt and that will intensify greatly in the near future, let's hope not too much, it's is very important to look at the ecological impacts of protecting remaining ancient forest and in trying to restore ancient forest on a grand scale. Under most climatic change impact prediction models many parts of Cascadia can expect even larger annual precipitation totals, although the variance from year to year is expected to be greater than in the past. Crucially though, this precipitation is supposed to fall in a more concentrated and intense manner and a far larger portion of it will fall as rain instead of snow, that builds a

slow melting snow pack, compared to historic baselines. Ancient forests with their buffering, moderating and slowing impacts on the flow of water will be evermore crucial as humanity deals with the intensifying impacts of climate change. The thermal cover of these forests will also help slow the melting of the diminished snow-packs of the future. Also, since precipitation will be more concentrated and the evaporative power of the sun will increase with climate change, droughts will become more common and intense and the giant "sponge" effect of ancient forests will help moderate water temperatures in hot times and water supply issues. In addition, the young forests that are being restored to try to create conditions that will create new ancient forests will sequester carbon from the oceanic-atmospheric system some of the highest rates of any systems in the world and as these forests age they will hold that carbon from being cycled rapidly for millennia. Of course the remaining ancient forests will continue to hold the highest carbon load per acre of any systems in the world and the gradual movement of young forests to join ancient forests in ever greater acreage will be one of the best signs of hope. Humanity must moderate many behaviors though if ancient forests are to persist because even though these systems are among the most resilient in the world, they too have their limits. They can moderate and weather climate change to unknown ecological tipping points and then they too will be overwhelmed. Humanity must not let this come to pass.

Why ancient forests now so imperiled is somewhat complex, which should come as no surprise. Some of the reasons have to do with the still greatly environmentally impactful damage done by the exploitive program of industrial logging of ancient forests in Cascadia: Erosion from clear-cuts and roads, changes to fire regimes, fragmentation of habitat, loss of structural complexity in forests and waterways, loss of thermal cover and so on... Another set of reasons have to do with the impact of other environmental problems on these "protected" forests: Climate change, invasive species, habitat loss in other systems and so on… Of course, both sets of problems interweave and reinforce each other.

Examining the factors that are still endangering the persistence of the ancient forests, it is clear to me that impacts to the global ecosystem, the ecosphere, impact the ancient forests of Cascadia, and impacts to the

ancient forests of the Cascadia, impact the health of the global ecosystem. That is, the Earth is, for most human purposes, essentially a closed and finite system and therefore everything that happens in this system in some way impacts every other part of this system. This line of thinking brings to mind my experiences with the phenomenon of climate change. As I have previously stated, ancient forests are resilient to climate change and moderate climate change, to a point.

I first learned about climate change when I was 8 or 9 old; it was called the "Greenhouse Effect" or the "Enhanced Greenhouse Effect" at this time. To examine the evolution of my perspective regarding climate change, I will put forward a thought experiment. If I could break, or maybe bend, the laws of space and time and bring my young self to meet my current self, I think some great transformative learning would happen. It is hard to know what aspects of the current, 2016, climate situation would be most shocking to my younger self. I certainly know that my younger self would be amazed by how little humanity had done to address the threat of climate change, even by the standards of what we had known in the late 70's, and of course especially given what we had learned in the period leading to the current day. I also know that my younger self would be amazed by how much the impacts of climate were being felt in 2016 because the general discourse consensus in the late 70's, even among most climate scientists, was that the most severe and readily evident impacts of a changing climate would impact mostly future generations of humans. Some stated that it was possible that some of the people who were children in the late 70's, like me, might possibly start to feel some impacts of climate change late in a life of many years if actions were not taken to address the human enhanced greenhouse effect. My 2016 self would tell my 1978-9 self, "Look we are in our mid 40's not our 80's or 90's and yet we are feeling impacts from climate change that are *more* severe than most predications of the impacts we would feel in our later years. It turns out that the climate (oceanic-atmospheric) system is more complex than we assumed and so is human behavior regarding reactions to a climate changed by human behaviors. In the "Western World" we depend so much on science to raise our living standards and yet under the influence of capitalist consumption models we largely ignored a foundational scientific law of complexity, the precautionary principle, in which we err on the side of caution

with humility of admitting that we don't know everything, or even enough, about the complex systems of the world. At this point in the climate change narrative, the damage is so great that denial, downplaying, and technological and market based optimism have far too much sway in the discourse, especially in the U.S.

As I pointed out the ancient forests of Cascadia have a profound impact on the relative stability of global climate. Consequently, the loss of most of these forests, in relative *moment* in time, profoundly shook the global climate. To expand on this last statement, in 1990 Mark Harmon, William Ferrell and Jerry Franklin conducted a study that concluded that, "A mere 0.017% of the Earth's land surface, old-growth forest conversion [in western Oregon and Western Washington] appears to account for a noteworthy 2% of the total [Carbon] released [into the atmosphere] because of land use changes in the last 100 years" (Harmon, Ferrell, and Franklin 1990, p. 701). I would say that the use of the term "noteworthy" to describe an impact that is ~117% of what would be expected if all lands were equal in impacts on carbon cycling, in quite an understatement. Given the disproportionate impact of Cascadian ancient forests on carbon sequestration, the restoration of as much of the ecological complexity of these forests as possible could go a great distance in moderating the impacts of climate change and could in turn help ensure that future generations will be able to experience ancient forests.

I would say that locked in such a desperate, but still "winnable" to a large degree, race to bring the levels of ecological literacy up so much in so many people in such a short period of time we environmental educators are going to really have to examine the way humanity has learned best throughout our evolution. I am not saying current approaches will not have to be modified. There are too many people, landscapes are too degraded, and there are aspects of our culture that are beneficial, but the core principles need to hue towards the way of relating to the rest of the living world that have been tested by time.

To make the point for how important I feel this educational approach is at this time, I will relate another moment when my ideas about the environmental literacy crisis were transformed. A professor who I admired pointed out that when people are asked if it is important for humans to protect the environment the

responses are very heartening for environmental educators, that is, a large majority believe it is important. When asked to qualify their responses, that is, "how important is it", again the answers are encouraging. However, given that these environmentally friendly attitudes are apparently very widespread in the population and quite deeply held, then how could we possibly have come to be in such a perilous environmental situation globally? Using the ideas of complexity theory, it should come as no surprise that things are more complex than framing a question about concern for the environment as if that concern is isolated from all other concerns that people have. In fact, all concerns, desires, and so on… interweave and influence one another and it is from the influences of a complex set of values, beliefs, knowledge and experiences that one concern rises above the others. My professor said that when you look at the question of people's concerns about the environment in a way that recognizes complexity of thought then unfortunately the environment usually falls somewhere well down the prioritized lists that people make. This answer both on its surface, and in a deeper sense, has profound implications for environmental educators.

One of the most recognized, oldest, and most utilized national polls in the United State is the Gallup Poll.[43] Probably the most well-known and quoted part of their many survey products is the *Most Important Problem* survey (Gallup 2016). I think this survey can be useful in interpreting environmental attitudes and therefore, I feel, it can also be useful in exploring ecological literacy levels. Let me go into more depth because I think the connection between survey responses and environmental literacy might be somewhat opaque. If people can take stock of their world and think that the health of the environment is not absolutely the most important thing in their lives, and about 97% of respondents are saying this be selecting another problem as most important, then this, to me, is a sign of deep and widespread environmental illiteracy. Of even greater concern though is the very idea that any topic of concern can be separated from the health of the environment. This shows that there is a fundamental flaw in the worldviews of a very large proportion of the population of the U.S.

[43] They have also been conducting research on public attitudes about climate change since 1997.

For many decades, economic issues have topped the list of concerns for a solid plurality of Americans. To my earlier point, how can the economy be separated from the environment? A thriving economy, or any economy at all, without an environment that stays within certain critical parameters is pure fallacy, an impossibility under the natural laws of Earth. The premise is wrong and the framing is wrong; catastrophically wrong. Given how much the economy is on the minds of the people, if we, as environmental educators, can try in a variety of ways to make the connection between a healthy environment and a healthy economy clear we would move a long way towards our goals. This is certainly something I am doing more and this connection, and disconnection plays a large part in my project and my work beyond this project.

I think it is very important that the question of the most important problem is asked in an open-ended format without additional prompts or offered categories. I feel that asking the question in this manner allows responses to show how salient environmental problems really are in comparison to all other potential problems on peoples' minds.

I think the results of this survey are another crucial piece of evidence in making the case that current dominate forms of environmental education are not in any way reaching their potential and they are certainly not reaching the level of cultural impact necessary to greatly increase levels of eco-cultural resilience in the United States. I mean considering the consequences of not heeding all the ecological/environmental warnings signs, that should be apparent to everyone, the numbers regarding concern for the environment are beyond disturbingly low. It is up to environmental educators, activists, and advocates, and the growing numbers who are all of these, to make the environment more important in people's minds by making connections to the environment personal. It is obvious people take a long list of concerns in personal and emotional ways that keep these things on the top of their minds.

Of even deeper relevance to my project, but overlapping with the Gallup results, are my experiences interacting with the 2000+ people I have lead in educational excursions into complex natural settings. On these outings I have listened carefully to the questions, stories, facts, and myths that participants have

wanted to share with me and the group. From these interactions I know, due to my own experiences, that the vast majority of these participants still know far too little about complex nature for me to feel that we have a resilient culture built on values system based on an accurate interpretation of complex nature. I would point out that unlike the group of respondents in the Gallup Poll, the people I have taught by no means represent a random sampling. They are definitely a heavily self-selecting group and I think that makes my point stronger. These people had access to complex nature, that is it still existed to some degree nearby. They had the resources to access these places, like time, money, transportation, physical, and mental health. They wanted to be in these places and, most salient to my project, they wanted to be in these places to learn about them. That is, they were not visiting these places purely for recreational and aesthetic reasons. In fact, a majority of these people, by information they volunteered and in response to my inquiries, told me that they had attended other learning activities such as this. They also talked about reading books on these subjects and also attending classes on these subjects in more "traditional" educational settings. Given what I learned about these groups I would say it is quite safe to assume that these people would rank considerably higher in measures of ecological literacy than a like sized group randomly selected from the American population, like in the Gallup Poll.

Very often after hearing me teach for a little while a number of participants would self-deprecate about the knowledge they had. It was interesting though that given a little prompting and reassurance of no judgement, comparison or value grading, they would open up and could figure out numerous ecological riddles I would put forward. In short, most people, in my opinion, and the general collective opinion of the environmental education community, know far too little about the complex functioning of the living Earth system, but they have in them the evolutionary and culturally selected desires and skills to come up in understanding fast if given the proper learning environment, chosen with the right educational philosophy and in the company of the right kind of educational guide/facilitator.

So given all of this I think that coming into the beautifully complex ancient forests of the PNW with the ideas of holistic natural history and complexity education; natural complexity education, is the best way, the natural way, to raise levels of ecologically literacy and connection and emotion and cultural values valuing these things to levels that are at least much closer to the human norm and that will lead to far higher levels of eco-cultural resilience and maybe the span of time will reveal a path towards sustaining human culture and the human species.

Prescriptions

I would argue that natural complexity education, resulting from a collaborative process that spans much of society, should be widely adopted. I would add that this does not mean that classroom education needs to be eliminated, but that a more holistic and balanced approach to education is urgently needed. I feel that this approach, which values the ways humans attach to their environments, including other humans, is the most efficient way to move forward with addressing the global environmental crisis. I do feel that people must be encouraged to spend as much time in complex environments, especially ancient forests, as is possible, alone and in diverse groups. I also feel to make these experiences as fulfilling as possible learners must be given access to the knowledge and skills that will allow these experiences to be as holistic as possible.

From reflecting on my experiences, I can say that environmental education has to be prescriptive and even further than that it has to be motivational and inspirational. Hope has to come in the form of ideas and in instilling urgency and deep purpose. This is why I purpose my natural complexity education approach and in this section I will choose a few prescriptions, one smaller and one larger in scope, that I think can have real impacts.

The smaller scale, but “closer to home”, prescription is to encourage people to bring a diversity of native plant species, families and growth forms (trees of a range of sizes and forms, vines, shrubs, annuals, perennials herbaceous, evergreens, deciduous, conifers, angiosperms and so on…) into their home and neighborhood environments, that is into their “real” lives’.

To have an understanding of potential impacts from these actions, I would point to the learning and connection experiences I have had with planting my yard with over 50 native plant species from over twenty plant families. I planted multiples of many plants, especially plants that produced parts edible to humans. The myriad pollinator species that have been drawn to my backyard ecosystem has been amazing, instructive, and heartening. Since my native plants have become established at least 5 other native plants species have come in on their own; this gives some hope that at least to some degree things are starting to become self-organizing, a key attribute of complex natural systems. I only wish is that my neighbors shared my passion for this kind of restoration so my yard was not so much of an island.

My family and I have enjoyed native berries, nuts, and flowers and the many creatures drawn to this attempt to re-establish some of the natural complexity that would have been common a short time ago. Of particular interest, as I have mentioned, has been the incredible numbers and diversity of pollinator species that we have seen come to the blooms that, due to a diversity of plant species, have a long season from early Spring to well into Fall. The fact that the honey bee populations, a non-native but still important species, are collapsing in many areas due to a combination of factors, is gaining some purchase in many discourses throughout the nation and beyond. What is far less knows is that western North America has some of the highest native bee diversity levels in the world and that this diversity is also declining quickly due to number of factors including native nectar and pollen sources. Many of these bees are more efficient pollinators than honeybees and they will use some non-native plants, especially “weeds”, which as a rule have not been modified nearly as much as crop and ornamental plants, but they are far more drawn to native plants, especially a diversity of native plants (Xerces Society 2011).

My family and I have been able to notice the seasonal changes in the plants in our yard and the changes as the years pass and I add more plants and some die out and new plants plant themselves in the beneficial ecological structure I helped restore. This home environment means daily interactions with native plants, something that is astoundingly rare in my society even in a liberal, educated, environmentally focused town like Bellingham. I feel this experiential situation has benefited the physical, mental and spiritual health, our holistic health, of my entire family.

My native plants grow around my garden space and so I am also practicing a form of permaculture where the domesticated -landscape is designed to mimic the natural as much as possible. The native components that I have enhance the growth of my garden plants and vice versa. I do feel that wide adoption of permaculture practices, some of which are based on the processes of ancient forests, is certainly an important part of a solution to environmental challenges.

On a large scale, if humanity is to rise to the challenges presented by the global environmental crisis, forests are going to be a large part of the answer and forest focused actions will be particularly impactful in the western fringe of North America, where superlative forests grow. I envision employing huge numbers of people, including many former resources extraction workers from rural areas, to hand thin overly dense plantations in random patterns, girdling some trees for initial small snags, placing logs in streams and rivers, or maybe bundles if the trunks are very small. There will be inter-planting of tree species and other plant species that are not represented or underrepresented. Some of the excess wood from thinning will be chipped and placed the road beds of the decommissioned roads and then this material will be inoculated with beneficial fungal spores to speed up the roadbed restoration process. Culverts will be removed and stream channels will be contoured thorough former roadbeds and planted with riparian vegetation. In places where erosion of roaded hillsides is more extreme the hillsides will be re-contoured to a more natural slope and planted in native vegetation. Ongoing education/explanation of process will be offered to all involved in the restoration process and to wider communities in the region and beyond.

Wood will still be used for many purposes in Cascadia, as it has been for thousands of years, but this wood will be cut in a way that actually enhances forest diversity and complexity. I propose that humanity call for and implement massive forest restoration programs in Cascadia and world-wide with the goals of creating jobs, meaning, and purpose in peoples' lives and also forging stronger connections between humanity and the rest of the community. Also, the goal will be to promote higher levels of physical mental, and spiritual health, which will lead to more resilient societies.

I would propose that all these components would also serve as rich learning environments where learning is doing and doing is learning and diverse, adaptive, growing and evolving learning communities come to greater and greater understandings of natural complexity and in using the lessons of places like ancient forests they will act to bring more of this resilient, holistic complexity to their lives and use it to enhance the lives of others, human and non-human alike.

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